Guidelines
for Retention Tank Systems

Environmental Protection Department

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LLNL

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Approved by the ES&H Working Group

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Introduction

Research and development activities at Lawrence Livermore National Laboratory (LLNL) may generate wastewater that contains constituents in excess of sanitary sewer discharge limits. LLNL operates retention tank systems to collect this wastewater, store it temporarily until an appropriate disposal method is determined, and possibly treat the wastewater if it is nonsewerable or nonhazardous.

Federal and state regulations governing these tanks have become increasingly stringent in recent years. (**Appendix B** summarizes applicable federal and state environmental regulations.) The increased regulatory oversight of retention tanks is due to the potential for radioactive-contaminated and/or hazardous wastewater to leak or spill from a tank and enter the soil and possibly the groundwater.

Proper design and operation of wastewater retention tank systems can minimize the risk of a release of wastewater to the environment. When the installation of a new retention tank system or the modification of an existing system is being planned, waste minimization should be considered so that the volume and/or toxicity of the wastewater can be reduced, if not eliminated, in compliance with U.S. Department of Energy (DOE) Order 5400.1.[1] Overall waste minimization guidance can be obtained from the Environmental Protection Department's (EPD) Pollution Prevention Group.

To assist LLNL employees and their organizations in understanding and complying with regulations for wastewater retention tank systems, the Operations and Regulatory Affairs Division (ORAD) of EPD has prepared this document to describe the life cycle of the retention tank system, including:

- Roles and responsibilities.
- LLNL wastewater retention systems.
- System, design, construction, and installation.
- Operations and maintenance.
- Leak monitoring/leak detection.
- Spill control.
- Repair and closure.

Table 1 summarizes the life cycle of a retention tank.

Tank Assessments and Guidance Group

ORAD is charged with providing environmental guidance and support to LLNL organizations. The Tank Assessments and Guidance Group (TAGG) within ORAD has the responsibility for providing guidance on the design and operation of retention tank systems. TAGG assists in obtaining required permits for tank systems, interfacing with regulators, reviewing new designs, overseeing proper installation, operating systems properly, testing systems, and preparing required reports.

Guidelines for Retention Tank Systems

The guidelines for the life cycle of hazardous, radioactive, mixed waste, and nonhazardous wastewater retention tank systems are based on regulatory requirements and DOE Orders. This Guidance Document also provides best management practices that a Program can include as deemed appropriate by Program line management. For hazardous, radioactive, and mixed wastewater retention tank systems, the guidelines in this Guidance Document are presented as requirements for design, construction, installation, and operation.

Radioactive wastewater systems are included with the requirements for hazardous and mixed wastewater retention tank systems because LLNL's policy is to ensure that these systems are designed and operated to minimize the potential for a release into the environment in accordance with the Laboratory's "as low as reasonably achievable" goals. This policy is observed even though all present radioactive wastewater retention tanks are of extremely dilute concentrations, normally disposed of through the sanitary sewer, and are not covered by any federal or state regulations.

Recommendations to reduce the risk of accidents due to mechanical failure or human error are also included as best management practices for retention tank systems.

The requirements for design and construction of proposed nonhazardous wastewater retention tank systems are identical to those for hazardous waste retention tank systems except as stated. It is LLNL policy that all new wastewater retention tank systems be built to hazardous waste standards to help ensure that the tank systems can meet changes in hazardous waste regulations and to minimize the potential for a release to the environment.

Table 1. Retention Tank Life Cycle

Proposed or Planning Stage	Waste minimization must be considered. (See page 1.)
	NEPA/CEQA compliance and other environmental regulatory requirements must be determined (see Appendix B); documentation may be required prior to construction. (See page 5.)
	To ensure compliance with current regulations, contact TAGG for guidance. A summary of the Environmental Protection Department's responsibilities is included in Appendix C.
	Contact the Environmental, Safety, & Health Team for review during the planning stage.
Design	For hazardous and mixed waste tanks, an engineering assessment that is certified by an independent, California-registered, professional engineer is mandated by law prior to use. (See page 6.)
	In general, a wastewater retention tank system must be designed to have secondary containment, leak detection/monitoring, corrosion protection, and overflow and spill prevention control devices. (Specific information begins on page 8.)
	Retention tanks whose contents are greater than or equal to 5% "oil" must be included in the facilities' Spill Prevention Control and Countermeasures Plan. Overflow and spill prevention control devices are mandated. (See page 9 and Appendix D.)
	For regulatory design requirements, see the Retention Tank Design and Construction Checklist in Appendix D.
Construction and Installation	For general information on construction and installation, see page 10.
	For regulated tanks, various aspects of the construction activities must be certified. (See pages 10–11.)
	For nonhazardous (i.e., nonregulated) tanks, the same certification process shall be followed to ensure uninterrupted operation if hazardous waste is stored in the tank in the future.
Operation and Maintenance	For general information on operation and maintenance, see pages 11–15.
	For hazardous and mixed waste tanks, inspections are mandated by law (see Appendix E and Appendix F). More extensive inspections are required or recommended as bimonthly, quarterly, and yearly intervals. A sample maintenance log is provided in Appendix G.
	For nonhazardous tanks, weekly inspection of the visual portions is recommended as a best management practice.
	Operation and maintenance activities must be maintained and documented for a minimum of three years for hazardous and mixed waste tanks.
	Appendix H outlines the procedure for handling rainwater in secondary containment areas and provides release forms for nonhazardous or radioactive tank systems and for hazardous or mixed waste tank systems.
Leak Monitoring	For general information on leak monitoring, see pages 16–19. For new tank systems, secondary containment with leak detection is mandated. For existing, single-walled underground storage tanks, an annual leak test at a minimum is mandated. ORAD coordinates the testing of tanks by a contractor. (See page 16.)
	Leak monitoring records must be maintained for a minimum of three years.
	If a leak were to occur, it must be stopped expeditiously. Leaks to the secondary containment must be recorded. Leaks to the environment must be reported.
Spill Control	For general information on spill control, see page 20.
	For spill prevention, several factors minimize the chance of an accidental spill, including tank design and regular, scheduled maintenance. (See page 20.)
	For spill response, various measures are used to prevent spills and, if a spill occurs, prevent or minimize environmental and personnel damage. (See page 20.)
Repair and Closure	For general information, see page 21.
	For regulated tanks, minor repairs do not need regulatory approval prior to the start of the repair. (See page 21.)
	Documentation of repairs must be recorded for hazardous and mixed waste tanks, and the documentation maintained for five years by the Program. This is also recommended for radioactive and nonhazardous waste tanks. Plans for major repairs and closures require advance regulatory approval. (See page 22 and Appendix I.)
	Disposal of regulated retention tanks must be documented in a Closure Report to the regulators (see pages 22-23).

Unpermitted releases to the environment that could potentially affect surface and/or groundwater quality violate the state of California's Porter-Cologne Water Control Quality Act.[2]

For existing nonhazardous wastewater retention tank systems and for proposed emergency-use retention tank systems, the requirements for design and construction are only recommendations. For other issues, such as the operation of nonhazardous wastewater retention tank systems, this Guidance Document states the differences in requirements for nonhazardous versus hazardous, radioactive, and mixed waste retention tank systems.

Responsibilities for Wastewater Retention Tank System Life Cycle

LLNL **Programs** are responsible for incorporating environmental, safety, and health considerations into tank system designs with assistance from the **Environmental, Safety, and Health (ES&H) Team** during the design process. The Programs are also responsible for ensuring that their retention tank systems are operated properly, including routine inspections and maintenance, wastewater and sludge handling, spill response, and other activities related to the operation of retention tank systems. The activities may be performed by Program personnel or by members of the ES&H Team, as requested by Program line management. The Facility Manager is the tank "owner."

EPD provides guidance and services to ensure that LLNL can meet its environmental responsibilities as stipulated by environmental legislation, regulations, and DOE Orders. EPD guides LLNL Programs in meeting these regulations and maintaining adequate environmental protection. (See **Appendix C** for a detailed summary of EPD's responsibilities in the retention tank life cycle.) The EPD staff is organized into three divisions: Environmental Restoration Division (ERD), Hazardous Waste Management (HWM) Division, and ORAD. The EPD Training Section trains LLNL personnel as required for the various environmental activities located within EPD.

Through the establishment of a Department Quality Assurance Office, Quality Assurance Manager, and quality assurance staff, EPD has established a Quality Assurance Management Plan that contains the Department's requirements for quality affecting activities.

LLNL Wastewater Retention Tank Systems

LLNL wastewater retention systems consist of underground tanks, aboveground tanks, or a combination of underground and aboveground tanks; piping; pumps; and ancillary equipment for collecting dilute rinsewater and wastewater generated by research activities. Most wastewater retention tank systems are used to collect and temporarily store dilute, nonhazardous rinsewater from rinsing operations that are part of various processes and operations. The tank systems prevent discharges to the LLNL sanitary sewer system above discharge limits established by the City of Livermore and provide proper storage until appropriate disposal occurs.

When a retention tank nears capacity, the tank is isolated from the waste stream to prevent further collection of wastewater. A representative sample is taken and analyzed to determine whether the contents meet sanitary sewer discharge limits as specified by the City of Livermore and the U.S. Environmental Protection Agency (EPA) categorical pretreatment standards. Samples are analyzed for those constituents that could be present in the normal, operational, waste-generating process and that have the potential to enter the retention tank system. In the case of categorical processes, samples are also analyzed for additional regulated parameters. If the results of sample analyses indicate that the tank contents are within sanitary sewer discharge limits, the tank contents are released to the sanitary sewer.[3]

If the results of sample analyses indicate that the tank contents are not within discharge limits, the HWM Division is contacted to arrange for proper treatment and/or disposal.

Types of Systems

Retention tank systems are used to collect and store four different types of wastewater: hazardous, radioactive, mixed waste, and nonhazardous. It is LLNL policy that all new and upgraded hazardous, radioactive, mixed, and nonhazardous wastewater retention tank systems be designed and constructed to meet hazardous waste storage tank regulatory requirements for new installations. Hazardous, radioactive, and mixed wastewater retention systems must be operated, inspected, monitored, and maintained to meet the regulatory requirements specified in this Guidance Document. Where appropriate, best management practices have also been identified. Best management practices are also identified for nonhazardous systems. Summary tables that outline these requirements and recommendations are provided in **Appendix D**. Each Program should determine whether it is appropriate to institute best management practices for operation of its retention tank systems, based on the potential hazards of the system.

Tank/Waste Categorization

Wastewater retention tank systems are most often linked to specific Programs and/or buildings; thus, the

contents of the discharge can be anticipated in the system design, and appropriate analyses can be performed.

According to federal and state regulations, the owner of the tank system is responsible for categorizing the type of tank system (as hazardous, radioactive, mixed, or nonhazardous) in order to determine the applicable tank regulation requirements. Environmental Analysts from TAGG and the Environmental Operations Group (EOG) in ORAD assist the Programs in determining the appropriate category. For existing systems, samples of the wastewater are taken periodically and analyzed to verify that the tank system has been properly categorized. For new tank systems, the expected wastewater constituents, as identified by the Program, will be used to categorize the tank for design and regulatory requirements. Either the tank operator, the HWM Field Technician (HWM Field Tech), or a TAGG Environmental Analyst will take samples (1) after the system operation begins and (2) periodically after that. The purpose of the sampling is to verify that the tank system is properly categorized and designed to store adequately the contained wastewater at a frequency agreed upon by the Program and EPD.

Emergency-Use Retention Tanks

LLNL also maintains some retention tanks that are normally empty, that do not accept a continuous waste stream on a regular basis, and whose only purpose is to provide temporary storage for potentially hazardous, radioactive, or nonsanitary sewerable wastewater generated during an emergency. After the emergency has passed, the contents of the emergency-use retention tank are isolated, a representative sample is taken, and the sample is analyzed. If the sample analysis report indicates that the emergency-use tank content is nonsewerable waste, the HWM Division is contacted to arrange for proper treatment and/or disposal. If the wastewater is shown to be sewerable, the tank contents can be discharged to the sanitary sewer system at an EPD-approved location. For approved discharge locations, contact ORAD's Water Guidance and Monitoring Group (WGMG) Responsible Person (RP). After the emergency use tank is emptied, it is evaluated for contamination, decontaminated if appropriate, and returned to use as an emergency-use retention tank.

Typical System

A typical retention tank system built to present-day standards would include, but would not be limited to, the following design features (see the "Retention Tank System Design and Construction" section for more details):

- Secondary containment for all tanks, piping, and ancillary equipment.
- Overfill-protection devices, such as level indicators and high-level alarms.
- Leak detection/monitoring for tanks and underground piping.
- Spill-prevention devices, such as dry-disconnect couplings.
- Pumps and control valves located within secondary containment.
- Locking valves on discharge piping.
- Control panel with alarms and indicators.
- Dual tanks for redundancy.
- Accessibility for leak testing and waste removal.
- Adequate mixing capability to prevent sludge accumulation and ensure representative samples.
- Freeze protection of aboveground piping and valves.

Figure 1 shows the basic design and the components of a typical retention tank system. However, the system shows a pump used for recirculation; this arrangement is not the preferred method for mixing tank contents. The use of mechanical mixers or air spargers is typical of preferred mixing methods. The system depicted in **Figure 1** receives wastewater via a gravity drain system from one or more buildings producing the wastewater. The wastewater is directed through double-walled underground piping to Tank 1 (a pump-up station), located within an underground vault to allow for gravity flow. A level sensor, with high-level alarm, activates Pump 1 when the level of wastewater reaches a predetermined height (usually 75–90% of tank capacity, depending on the system design); and the wastewater is pumped into one of two aboveground tanks.

When the level of wastewater in Tank 2 or Tank 3 reaches a predetermined height, the wastewater is directed to the other aboveground tank automatically or manually. This feature allows operations to continue while the contents of the full tank are being analyzed and disposed of. An overflow pipe is provided in case the wastewater flow is not diverted from the full tank to the empty tank (due to mechanical or human error).

Piping to Tanks 2 and 3 and to Pump 2 is configured to allow the transfer of wastewater from one tank to the other or to circulate the contents prior to sampling and discharge to provide for representative sampling and to prevent accumulation of sludge. When the tank contents are to be disposed of, Pump 2 is used to discharge the contents of the selected tank to a portable tank or tank truck for disposal, or to the sanitary sewer if the contents are within the sanitary sewer discharge limit.

Variations of the system shown in **Figure 1** could be used for different system configurations. For example, retention systems that originate with a pump-up station would have aboveground piping and would not require a tank in a vault (Tank 1) or the associated pump (Pump 1). Other variations might also be required or desirable, depending on individual conditions.

In some cases where an underground tank is used in a low-flow system, the transfer operation to an aboveground tank might be a manual operation. The use of two or more aboveground storage tanks is strongly recommended by EPD for all new systems and is recommended as an upgrade for existing systems because this configuration provides system redundancy. While one tank is isolated and its contents are awaiting disposal after sampling, the other tank continues to receive wastewater, allowing programmatic activities to continue uninterrupted.

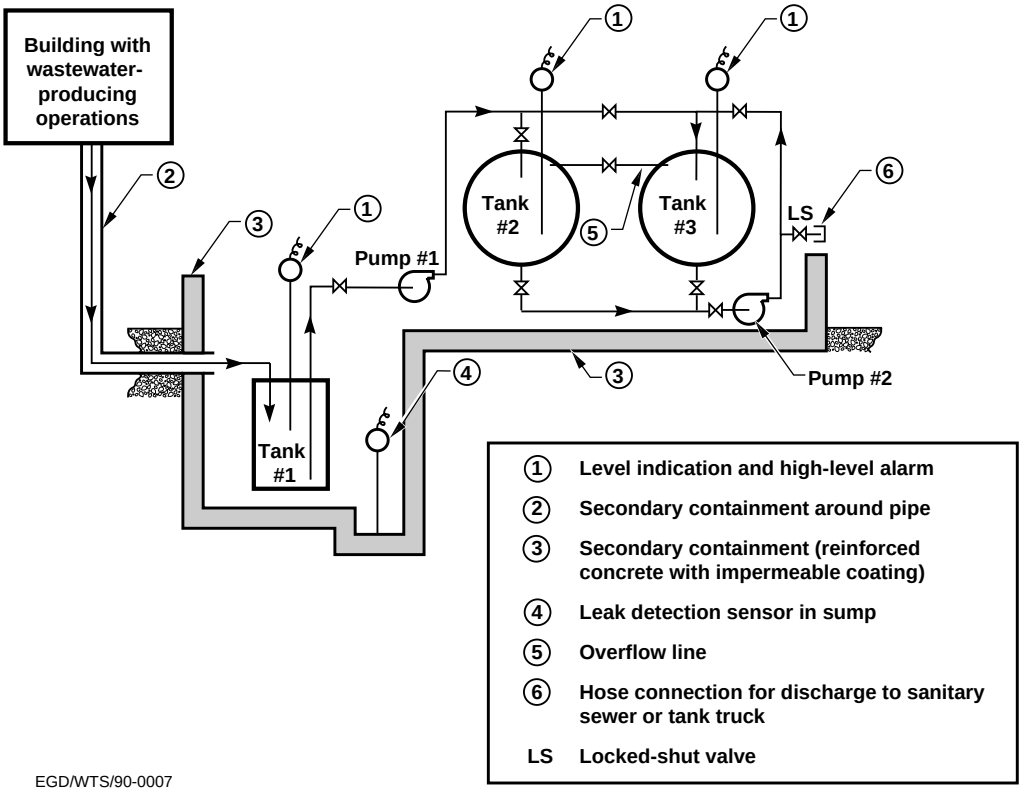

Figure 1. Schematic of a typical retention tank system.

Retention Tank System Design and Construction

The following guidelines have been developed to ensure that environmental requirements and concerns are addressed in the design, construction, and management of wastewater retention tank systems.

NEPA/CEQA Compliance

EPD, through the Environmental Evaluations Group (EEG), provides guidance to planners or designers on the environmental evaluation documentation required for projects. (**Appendix B** summarizes environmental regulations for retention tanks.) Programs are responsible for notifying the EEG of any projects that may require National Environmental Policy Act (NEPA)/California Environmental Quality Act (CEQA) compliance. All tank projects must be evaluated for NEPA/CEQA compliance, and a determination must be made of the level of documentation required. This process should commence early in the project planning because review and approval of NEPA evaluations may take several months (or longer for an Environmental Impact Statement [EIS]) or Environmental Impact Report [EIR] and must be completed prior to the start of Title II engineering and design activities. Contact EEG for further guidance.

Most routine tank activities, such as tank closures, upgrades (including complete replacement of an existing system), and repairs, may be covered by a DOE Categorical Exclusion for LLNL and will not require more in-depth NEPA documentation. Other activities, such as new tank system installations, will normally be included in NEPA documentation required for the overall facility project. If not included in NEPA documentation for the facility, new

tank system installations will generally require their own documentation.

Design Review of New or Upgraded Tank Installations

The design of any new or upgraded tank system must be reviewed by the responsible ES&H Team. As part of the ES&H review process, the EOG Environmental Analyst is responsible for providing TAGG the opportunity to review the tank system design. This review process is necessary to ensure that the design is in accordance with all applicable federal, state, and local environmental requirements. Because changes are often necessary to address issues from all the various disciplines represented on the ES&H Team, coordination of the review process should be arranged early in the project planning stages so that any comments or changes can easily be incorporated into the design. It is the responsibility of the Program to initiate the review process.

Engineering Assessments and Engineering Evaluations

To comply with *Code of Federal Regulations* (CFR), Title 40, Parts 264.192(a) and 265.192(a),[4] and/or *California Code of Regulations* (CCR), Title 22, Sections 66265.192(a) and 66264.192(a),[5] all new or upgraded hazardous waste or mixed waste tank systems require a written engineering assessment. For tank systems being changed from nonhazardous to hazardous waste storage, an engineering assessment must be prepared before the tank system is used to store hazardous or mixed waste. The purpose of an engineering assessment is to demonstrate that a tank system is structurally adequate and designed in accordance with all applicable standards such that it should not allow the transmission of wastes to the environment. The engineering assessment must be certified by an independent, qualified, California-registered, professional engineer and must be on file before a system is put into use. A TAGG Environmental Analyst coordinates the preparation of the written engineering assessment.

Engineering evaluations are prepared for all new or upgraded nonhazardous or radioactive retention tank systems. They are internal documents prepared as a best management practice and are kept on file with TAGG. These evaluations are identical to engineering assessments for hazardous and mixed waste tank systems except they are not certified by an independent, professional engineer. If a Program wanted to change the use of a nonhazardous or a radioactive retention tank system to store hazardous or mixed waste, then TAGG would retrieve the engineering evaluation from the file and give it, along with any new information, to an independent, California-registered, professional engineer for certification before the new use is implemented.

Engineering assessments and engineering evaluations are normally prepared by EPD through TAGG from information supplied by the tank owner. It is the responsibility of the Program or Program representative to make this information available to the TAGG Environmental Analyst. If the Program or an outside contractor prepares the engineering assessment or engineering evaluation, TAGG provides guidance on the preparation of the document and reviews the completed document.

To complete an engineering assessment or an evaluation and obtain the certification when required, a Program needs the following items:

- Engineering drawings.
- Construction specifications.
- Design standards, including seismic analysis.
- Corrosion inspection and certification of proper field installation of corrosion protection system (where corrosion protection is required) by a corrosion expert.
- Installation inspection and certification of proper installation by an independent engineer.
- Tightness test and certification of leak tightness.
- Operation description.
- Waste characterization.
- Compatibility of the waste with the tank's construction materials.

For specific requirements of the engineering assessment or evaluation, the Program or the engineer in charge of preparing the assessment or evaluation should contact TAGG.

Design of a Retention Tank System

The basic concept controlling the design of a retention tank system is to prevent the release of wastes to the environment by providing both primary and secondary levels of containment, leak detection, and spill and overfill protection. By LLNL policy, primary and secondary containment is required for all hazardous, radioactive, mixed waste, and nonhazardous wastewater retention tanks. The primary and secondary levels of containment must be compatible with the material stored and be leak-tight.

In addition, a leak monitoring program that will detect leaks from the primary containment into the secondary containment must be implemented. Overfill protection and spill prevention devices are also required.

The Retention Tank Design and Construction Checklist (**Appendix D** of this document) provides useful and detailed information on the subject of design and construction of retention tank systems. Contact TAGG for specific requirements applicable to an individual retention tank system design.

General Considerations. It is generally advisable to have retention tank systems designed such that the major portion of the tank system is aboveground, allowing all portions of the tank to be easily inspected visually for leaks. The installation of underground tanks and piping should be avoided or minimized. A dual-tank system (as shown in **Figure 1**) is recommended so that a second tank is operational while wastewater from the first is being analyzed. It may require several weeks for the results of the analyses to be returned; therefore, it is recommended to size the tank system so that Program operations can continue for a minimum of four weeks while the results of the analyses are being determined. Additionally, the size of a tank should be designed to hold up to four weeks of wastewater discharge. However, the tank should be less than 5,000 gallons in capacity and hold less than 45,000 pounds of waste. Tanks that exceed the limits in capacity and waste storage require a tank specific permit from the state.

All retention tanks must have the capability to mix the tank contents thoroughly to prevent sludge from accumulating and to ensure that the contents are homogeneous for representative sampling. Mixing systems that employ air sparging or mechanical mixers provide the most efficient means of mixing and will typically be adequate to suspend solids.

Mixing by pump recirculation is not recommended because its efficiency is governed by tank geometry and mixing intensity. For adequate mixing of solids using pump recirculation, the required mixing intensity ranges from 0.5 to 2.0 horsepower per 1,000 gallons or greater, depending on tank geometry. For systems that employ pump recirculation for mixing, a general guideline is that there should be at least one complete recirculation of tank contents prior to sampling or discharge. Contact TAGG for assistance regarding mixing criteria and design features.

From time to time, it becomes necessary to clean the tank system or repair or replace worn parts. Accessibility to tanks and ancillary equipment and the ease of maintenance are important considerations in the design. The design should also facilitate leak testing of the tank system, including the secondary containment. Such testing may require that additional accesses, vent valves, break-down joints, or other special devices, such as boots or flanges for double-walled piping, be installed.

One of the most common places for a retention tank system to develop a leak is the junction between the tank and its piping. This connection often experiences considerable fatigue from a variety of forces and eventually fails, or the seal at the connection might not be suitable or might not have been installed properly and soon develops leaks. It is important that all connections between the tank and its piping be carefully designed and installed. All seals, including gaskets above the normal, in-use level, must also be leak-tight. It is also desirable to incorporate flexibility into the connection and to choose a sealing system that will be leak-tight for the useful life of the tank system. In general, to prevent leaks, a flexible coupling or an equal design feature providing strength and flexibility is used, and a durable and effective seal employed.

Leaks are also caused by the wastewater freezing; freezing can cause failure of piping and valves. Freeze protection is required by DOE for systems that could have water standing in exposed piping. Insulation and electrical heat wrap tape are recommended for freeze protection. Other equipment sensitive to low ambient air temperatures should also be protected.

Another cause of leaking retention tank systems in the past has been inadequate or nonexistent corrosion protection and ultraviolet degradation. Protection must be provided for both tank system components that are subject to corrosion, and for plastic, fiberglass, or rubber components that are subject to ultraviolet light. If any external metal component of the system will be in contact with soil or water, a corrosion expert must determine the type and degree of corrosion protection necessary. The amount of corrosion protection needed is dependent on the project design. Extensive corrosion protection may require a corrosion expert to supervise and to certify the field installation of a corrosion protection system, whereas simple protection may only require the application of a coat of paint or use of corrosion resistant materials, such as fiberglass. Buried metal tanks and piping require that dielectric coatings be used for such areas as exposed pipe threads and that isolation bushings be used for connections to metal tanks. When external tank shells and tank components are expected to be in contact with soil and water, it is recommended that these system components be nonmetallic or coated to prevent corrosion.

All outlets from retention tank systems require engineering and administrative controls to prevent illegal discharges. Typical outlets are a berm drain, hose connection, or sanitary sewer connection. Locking caps or locking valves on these outlets usually satisfy this requirement. The document, *Guidelines for Discharges to the Sanitary Sewer System*,[3] has more information on the topic of discharging from retention tank systems. Also, it is recommended that, if feasible, locks be installed on tank accesses to prevent unauthorized discharges into tanks.

Primary Tank. Primary tanks are fabricated from a variety of materials but are typically constructed of cross-linked polyethylene, fiberglass-reinforced plastic, or steel.

The tanks come in a variety of configurations. However, tanks that are supported by saddles or other devices that allow for direct viewing of the entire surface of the tank, including the bottom, are recommended.

Tanks should allow for internal inspections by means of removable covers or accesses adequately sized for personnel entry if that becomes necessary.

Primary containers must be completely leak-tight, and compatible with and impervious to the material contained. Tank manufacturers often provide a compatibility chart describing the relative resistance of their tanks to certain chemicals. If no such data exist for the chemicals that are expected to be stored in the tank system, then in-house tests must be completed, and documentation of the tests must be included in the engineering assessment or the engineering evaluation of the system. In order to facilitate any repairs or disposal of the tank at the end of its useful life, it is advisable to obtain a Materials Safety Data Sheet (MSDS) from the manufacturer for the primary container and any coatings that will be in contact with the liquid. This information can be easily obtained during the design stage.

It is advisable (required for regulated underground storage tanks [USTs]) to obtain certification from a tank manufacturer that a tank is leak-tight. It is required that a leak-tightness test be performed on the entire retention tank system, including the secondary containment, after installation is completed. If all surfaces of the primary tank can be visually inspected, a visual leak-tightness test may be performed.

The primary containment must be capable of resisting all expected loads, including seismic loads; and an appropriate factor of safety must be applied. Seismic and wind-load design requirements can be found in *Design and Evaluation Guidelines for Department of Energy Facilities Subjected to Natural Phenomena Hazards*.[6] Plant Engineering and/or TAGG may be contacted for any additional requirements. The design must also consider the ability of the supporting soil and tank foundations to support the total load of the system. Proper anchoring must be provided to prevent flotation or dislodgment of the primary tank or any piping or component.

Secondary Containment. Secondary containment typically consists of a reinforced-concrete berm area, a reinforced-concrete vault, double-walled tank, or some equivalent device. The preferred method of secondary containment is a covered, bermed area because it facilitates visual inspections and maintenance of the tank and ancillary equipment. All methods are functionally equivalent with the exception of an excavation liner as secondary containment. An excavation liner is not recommended as secondary containment because the liner, once installed, cannot be leak-tested; and monitoring the space between the primary and secondary containment is often inadequate, difficult, or cost prohibitive.

Like the primary containment, the secondary containment must be completely leak-tight and impervious to chemical attack from the materials contained in the primary container. A bermed area or vault must be coated with an appropriate epoxy, resin, or grout to make it leak-tight and impervious to chemical attack. Similarly, double-walled tanks can be lined, coated, or constructed of special materials that render the system leak-tight and impervious to chemical attack. An MSDS for the secondary containment should also be requested from the manufacturer. Secondary containment located below grade must be capable of preventing both leaks of hazardous or radioactive substances into the environment and leaks of groundwater into the secondary container. A tar coating of the exterior of concrete containment structures is recommended in addition to an epoxy-type coating of the interior.

The secondary containment must be sloped to a point of collection; and, if possible, the point of collection must be easily visible. The low point in the secondary containment can usually be used for placement of leak detection sensors and equipment for removal of liquid. See the "Leak Detection" section for details on leak detection equipment requirements. Under normal in-use conditions, the secondary containment must remain dry and completely free from liquids and debris.

The secondary containment system must be designed to accumulate, temporarily store, and remove any wastewater or rainwater that enters it. The secondary containment for a single aboveground tank must be capable of containing 100% of the volume of any spill from its primary tank. Secondary containment for a site with multiple aboveground tanks is required to contain either 100% of the volume of the largest tank or 10% of the aggregate volume of all the tanks, whichever is greater. Secondary containment for a site with underground tanks is required to contain either 150% of the volume of the largest primary tank or 10% of the aggregate volume of all the tanks, whichever is greater.

Additional capacity for a 24-hour, 25-year storm is required for secondary containment open to rainfall. TAGG can provide further guidance on capacity required for rainfall accumulation.

To eliminate the possibility of rainwater entering the secondary containment, it may be desirable to design a covered secondary containment system. When it is not possible to cover the secondary containment, but the entry of rainwater into the secondary containment and the subsequent removal of that rainwater create a significant problem, another option may be to pump collected rainwater to an additional, small tank that is designed to store rainwater from several storms until the rainwater can be conveniently released. The "Spill Response" section provides additional details on the handling of rainwater.

The capacity of the secondary containment limits the capacity of the primary containers. The capacity of the secondary containment also restricts any future increases

in the retention tank system. A prudent secondary containment design includes, when possible, additional capacity for future expansion of the retention tank system and additional capacity to prevent spills in the event of splashing, wave action, or catastrophic failure of the retention tank system. Additional capacity is required if the secondary containment structure could receive water from a fire-protection sprinkler system.

Ancillary Equipment. Similar to the primary and secondary containment requirements, all ancillary equipment associated with hazardous and mixed waste retention tanks that could come in contact with the contained waste (such as pumps, valves, primary piping, and gaskets) must have secondary containment and leak detection, be leak-tight, and remain completely impervious to chemical attack. During the design phase, it is recommended that the tank designer obtain the MSDSs from the manufacturers for all ancillary equipment that must come into contact with the waste. This information can be useful to the operator and can assist in the disposal of the equipment.

The following items are exceptions, provided they are visually inspected on a daily basis (see the "Daily Inspections" section for further guidance):

- Aboveground piping (exclusive of flanges, connections, valves, and joints).
- Welded flanges, welded joints, and welded connections.
- Seal-less or magnetic coupling pumps and seal-less valves.
- Pressurized, aboveground piping systems with automatic shut-off devices.

Double-walled piping, jacketing, trenching, or a bermed area usually serves as the secondary container for the primary pipe or other ancillary equipment. In addition, such equipment must be supported and protected against physical damage and excessive stress due to settlement, vibration, expansion, or contraction.

Leak Detection/Monitoring. The design of any retention tank system must include a leak detection/monitoring capability that is designed and operated to detect the failure of either the primary and secondary containment structure or any release of liquid into the secondary containment system within 24 hours. Daily (including weekends and holidays) visual inspection (depending on the type of system) of the aboveground, visible portions of the system can substitute for a leak detection system, but such a substitution is not recommended. Continuous monitoring is required for the underground portions of systems or where visual monitoring is not possible, such as the bottom of a tank in contact with a pad.

Continuous leak detection systems are available in many different types and configurations. Systems include sensors that detect leaks into the interstitial space (between the primary and secondary containment) of a double-walled tank or piping, sensors that detect vapor or contaminants in groundwater monitoring wells, and sensors that detect liquid accumulating in a sump. Sensor technology is developing rapidly, and new products can be expected to be available in the future. TAGG and various trade publications are helpful in determining the best leak monitoring device. The following is a partial list of sensor types that are currently available:

- Continuous cable that detects and locates leaks.
- Floats that detect liquid accumulation in a sump.
- Vapor detectors used in a tank excavation observation well or groundwater monitoring well.
- Optical sensors that detect wet or dry conditions.
- Moisture sensors that detect the presence of liquid.

Visual and/or audible alarms must be included for continuous monitoring systems and located so that any alarm will be immediately noticed and fast response provided. In the case of vertical tanks resting on a pad where the bottom of the tank cannot be visually inspected, it is recommended that the pad be constructed in such a way that any leak from the tank bottom be routed to a sump that can be visually inspected or that contains a leak detection sensor.

Overfill Protection and Spill Prevention. Overfill protection is required to prevent releases of wastewater to the environment from the accidental overfilling of tanks. Such protection typically consists of level indicators with high-level sensors connected to one or more audible/visual alarms. The overflow protection device must not allow for manual override for hazardous and mixed waste USTs. Alarms should be located such that prompt attention and response are ensured. In some cases, it may be desirable to locate a remote alarm at an emergency-response duty station. It is often convenient to automate the system by having the level indicators work in conjunction with an automatic shut-off or an automatic bypass to another tank. Manual shut-off and diversion to a standby tank may be adequate for low-flow tank systems. However, manual systems are operator-dependent and may not be effective in the event that alarms go unnoticed. Other types of overfill protection include check valves in tank vents and overflow lines to adjacent tanks. Spill prevention devices include catchment basins around fill pipes and dry-disconnect couplings at hose connections.

The extent of overfill protection and spill prevention should be related to the expected flow rate, the relative hazard of the substance to be contained in the retention tank system, and the effect a spill or a system backup may have on Program operations. Fully automatic overfill protection is preferred because it can be implemented and operated

easily, and its benefits far outweigh the costs. Hazardous, radioactive, and mixed USTs are required to have a spill container that has a minimum capacity of 5 gallons and has a drain valve which allows drainage of the collected spill into the primary tank.

The design of overfill protection must preclude an intentional release of wastewater to the secondary containment. Any release from the primary container or ancillary equipment into the secondary container must be cleaned up but is not reportable to an outside agency unless the material waste enters onto or into the environment.

Details on overfill protection and spill prevention devices are contained in the Retention Tank Design and Construction Checklist in **Appendix D** of this document.

Construction of Retention Tank Systems

State and federal regulations require that some assurance be provided that tank systems are designed and installed properly. This assurance must be provided in the form of certifications for different aspects of tank system design and installation, depending on the type of tank system and the regulations that apply.

The Program representative is responsible for assuring that Plant Engineering or the contractor installs the tank system in compliance with the appropriate regulations. TAGG Environmental Analysts are available to provide guidance.

Because improperly constructed or installed tanks and ancillary equipment can result in a variety of problems (including future leaks, costly repair, or delays in operations), the following items are required, as applicable, for each new or upgraded hazardous, radioactive, or mixed tank system, and the items are recommended for nonhazardous tank systems.

Corrosion Inspection and Certification of Proper Design and Installation of Corrosion Protection Systems. Any external metallic tank shells or any metallic component of a tank system that will come in contact with the soil or water must be evaluated for potential corrosion by a certified corrosion expert. Corrosion resistant materials must be used when the corrosion expert determines they are required. For USTs that are regulated by the California UST regulations, a corrosion expert must design and certify field-installed cathodic protection systems as adequate. An independent corrosion expert must supervise and certify the installation of any field-installed corrosion protection system. Certifications of adequate design and/or proper installation of the corrosion protection system must be provided to TAGG for incorporation into the engineering assessment or engineering evaluation before the tank system can be put into use. The Program is responsible for:

- Providing the type and extent of corrosion protection that is recommended by the corrosion expert.
- Ensuring that a corrosion expert designs a field-installed cathodic protection.
- Arranging for the supervision of any field-installed corrosion protection system by an independent corrosion expert.
- Providing copies of the required certifications to TAGG.

It is recommended that the design and supervision of a field-installed corrosion protection system and certification of adequate design and proper installation of the corrosion protection system be included as a condition of the construction contract. In addition, the preliminary design should be reviewed by a corrosion expert to prevent costly redesign and contract changes.

Installation Inspection and Certification of Proper Installation. Plant Engineering or the contractor ensures that proper handling procedures are followed during installation to prevent damage to the tank system. Proper installation is ensured by performing an installation inspection and repairing any necessary items. The inspection must be performed by an independent tank installation inspector or by an independent, qualified, California-registered, professional engineer. The inspection must be performed prior to putting the system into use. A signed certification statement from the individual responsible for performing the tank installation inspection must be provided to the TAGG Environmental Analyst for incorporation into the engineering assessment or engineering evaluation. The certification statement must describe the inspection and any repairs that were made. It is highly recommended that the installation inspection, the certification of proper installation, and the receipt of copies of the documentation by LLNL be conditions of the construction contract.

Leak-Tightness Test and Certification of Leak Tightness. In order to obtain a leak-tightness certification, the tank(s), ancillary equipment, and secondary containment must pass a leak-tightness test after construction is completed. It is a regulatory requirement that double-walled tanks and piping (both primary and secondary) of hazardous and mixed waste tanks be tested for leak tightness after installation, but before the system is put in service. It is strongly recommended that vaults, berms, and other types of secondary containment be tested for leak tightness also. The leak-tightness test can be visual if all portions (including the bottoms) of the tank(s) and ancillary equipment can be inspected by direct viewing. If a visual test is not possible, as is the case for underground piping, then a hydrostatic test, precision test, or some other equivalent type of leak test must be performed (see the "Leak Monitoring" section for details).

A certification statement that the tank(s) and ancillary equipment are leak-tight must be provided to the TAGG Environmental Analyst for incorporation into the engineering assessment or engineering evaluation before the tank system can be put into operation. It is the responsibility of the tank owner to make the proper arrangements for obtaining the leak-tightness test and certification. It is recommended that the receipt of copies of the leak-tightness test and certification be conditions of the construction contract. TAGG provides guidance on test operator qualifications, test procedures and standards, inspector qualifications, and certifications.

Certification of Proper UST Installation. For USTs that are regulated by California UST regulations, the owner or owner's agent must certify that the installation was performed properly by qualified personnel and that the system was inspected before being placed in use. The certification must show that:

- The installation was performed by an installer that has been adequately trained and certified by the tank and piping manufacturers.
- The installer has been certified or licensed by the Contractors State License Board or otherwise has met the state requirements for tank installers at LLNL.
- The underground storage tank, any primary piping, and any secondary containment system were installed according to applicable, voluntary consensus standards and the manufacturer's written installation instructions.
- All work listed in the manufacturer's installation checklist has been completed.
- The installation has been inspected and approved by the local agency or, if required by the local agency, inspected and certified by a California-registered, professional engineer who has education in and experience with UST installations.

This certification must be recorded on a form provided by the State Water Resources Control Board and be provided to the local regulatory agency. The form is identified as "Certification of Compliance for Underground Storage Tank Installation Form C." Contact TAGG for copies of the form. TAGG will send the completed Form C to the appropriate regulatory agency. Before the tank system is operated, it is recommended that the system be swipe sampled to establish a baseline of the system's interior characteristics. Contact your TAGG Environmental Analyst to schedule this sampling.

A Summary of Responsibilities for Design and Construction of Retention Tank Systems

The **Program** is responsible for meeting all design requirements, initiating design approval, and coordinating the process with the ES&H Team Leader and TAGG.

A **TAGG Environmental Analyst** reviews new retention tank designs to help ensure compliance with tank design regulations and prepares reports on the adequacy and structural integrity of new and existing retention tank systems. The TAGG Environmental Analyst also provides assistance in leak-tightness testing for tanks and secondary containment in new or upgraded systems.

The **LLNL Contact** (Program representative) or the **contractor** is responsible for assuring proper system installation.

Operation and Maintenance

Procedures and requirements for the operation and maintenance of retention tank systems must be established to ensure safe performance. The goals are to ensure that personnel safety is provided for and to prevent releases of potentially hazardous materials to the environment.

It is the responsibility of the Program to assign a principal operator and backup. Operators may be Program staff, or they may be assigned from the Hazards Control Department or the HWM Division.

Routine Operations

The operator of the retention tank system is responsible for ensuring that the system is operated safely and within its design envelope. The Program must ensure that the operator has training appropriate for proper system operation and hazardous waste workers as described in the *LLNL Training Program Manual*.[7]

The Program must prepare and make available to the operators an Operational Plan describing operational requirements for the retention tank system and providing procedures and information necessary for the safe operation of the system. The Operational Plan must include the following information:

- The purpose of the retention tank system, including a description of the waste stored.
- Training requirements for operators and documentation requirements of the training provided.
- Operating instructions and procedures for all normal and emergency modes of operation for the system.

- A schematic of the retention tank system showing the valves and controls used for different modes of operation. **Note:** The Program must update the schematic to reflect any changes.
- Sampling instructions, including mixing requirements.
- Inspection and monitoring instructions.
- Maintenance schedules.
- Emergency response, reporting, and recording.
- Additional information as determined to be required.

The Program must ensure that responsible operators and backup operators are assigned and trained to operate and inspect the system properly and that they have the required training.

It is the operator's responsibility to be familiar with all operations of the retention tank system. The operator must:

- Arrange proper system valve lineups.
- Operate the control system, including leak detection and overfill prevention equipment.
- Perform inspections at the required frequency and monitor the condition of the system components to reduce the risk of equipment failures or to provide fast spill response.
- Document inspections in a log, file the logs, and make this information available for review.
- Report problems and changes in system operation when they occur.
- Supervise manual transfer operations between tanks.
- Ensure that required maintenance is performed and documented.
- Ensure that waste sample collection, analysis, and disposal are scheduled and completed to ensure that hazardous or mixed waste is stored 90 days or less unless the tank is part of the HWM's RCRA-permitted facilities.
- Document start of storage and disposal dates.
- Ensure that the retention tank is properly labeled (e.g., hazardous, radioactive, mixed, or nonhazardous).
- Perform mixing operation prior to sampling tank contents.
- Perform discharge to the sanitary sewer system after authorization from ORAD.

Guidelines for Discharges to Tanks

Discharges to retention tanks must be controlled so that:

- Equipment is not damaged and releases do not occur because highly corrosive or reactive chemicals have been added.
- Incompatible wastes are not combined.
- Intended or actual tank use is consistent with any applicable permits.
- Wastewater sanitary sewerability is maintained, if possible.

Retention tank systems that Programs use are not normally designed for the transport or storage of concentrated chemical or solvent waste, domestic-use waste, or rainwater; or for the storage of hazardous or mixed waste over 90 days. Hazardous and mixed waste cannot be stored for longer than 90 days. This 90-day period includes any time that the waste is stored in a Waste Accumulation Area.

The Program must be aware at all times of the types of waste being discharged to the tank system and ensure that the waste is compatible with the materials of construction for the system. Refer to *Guidelines for Discharges to the Sanitary Sewer System*[3] for guidance on wastewater discharge limits.

Guidelines for Air Emissions

Liquids containing organic compounds should not be discharged to a tank system unless the system is specifically designed to store such chemicals. In some cases, environmental permits are required to operate a tank containing these materials. For example, if the volatile organic compound (VOC) concentration is equal to or greater than 10,000 ppmw, the tank will require an air permit. Refer to *Guidelines for Permitting Air Emission Sources*[8] for guidance on the air regulations related to tanks. Contact your assigned EPD Air Quality Specialist for an evaluation of permitting requirements or with questions about specific proposed tank projects.

After June 6, 1996, if RCRA hazardous waste containing 100 ppmw or more of volatile organic (VO) compounds is discharged to a retention tank, the tank must follow certain standards, and inspection, monitoring, and recordkeeping requirements. The tank standards require control of organic emissions, and several control alternatives are available. Contact your EOG Environmental Analyst for an evaluation of requirements or with questions about specific proposed tank projects.

It is the responsibility of the Program to review periodically all discharges to the retention tank system. Any changes to the wastewater stream should be anticipated and reported to the TAGG Environmental Analyst before the changes actually occur so that material and chemical compatibility can be investigated, and the environmental regulations reviewed for applicability.

Inspections

The goals of an appropriate inspection program are to permit early detection of potential trouble spots and to implement corrective action to minimize the probability of

accidental releases of any wastewater. It is the responsibility of the Program to ensure that:

- For hazardous, radioactive, and mixed wastewater systems, the retention tank system is visually inspected on a daily basis.
- The specified inspections are performed on schedule. **Note:** More extensive inspections are required or recommended at bimonthly, quarterly, and yearly intervals. See **Appendix F** for the timing and extent of inspections and testing.
- Records of inspections are maintained.
- Deficiencies are identified, and corrective action is immediately initiated and documented.

For nonhazardous retention systems, it is recommended that inspections be performed weekly at a minimum. These inspections should be essentially the same as those performed for the hazardous, radioactive, and mixed wastewater systems as described below.

Daily/Weekly Inspections. Daily inspections of the aboveground portions of each hazardous, radioactive, and mixed waste retention tank system, including the visible portions of UST systems, are required (weekly inspections are recommended for nonhazardous tanks). The regulatory definition of "daily" is different for tanks with secondary containment and those without. (See "daily" in **Appendix A** glossary for details.) For aboveground or onground hazardous and mixed waste retention systems, the tanks and ancillary equipment, when complete secondary containment is provided, need only be inspected each operating day that any tank is in use. Operating days do not necessarily include weekends and holidays unless operations are conducted on those days. However, for hazardous and mixed waste tanks systems in use, the secondary containment systems must have continuous leak detection, or a visual inspection must be conducted for the presence of leaks or spills at least once every 24 hours, including weekends and holidays.

At a minimum, inspections must include visual examination of critical components (e.g., tanks, pumps, secondary containment, etc.) and leak detection data, if available. A permanent record of inspections is required. The following is a list of items that should be included in the daily inspection, where appropriate. (This list is provided only as an example, and it is not intended to be appropriate for every retention tank system.) The daily inspection should include a visual inspection for:

- Corrosion or releases from fixtures, joints, flanges, or pumps.
- Condition of materials (e.g., blisters, cracks, etc.).
- Leaks, cracks, buckles, and bulges in the tank shell.
- Signs of leaks, erosion, or corrosion in the area immediately surrounding the externally accessible portions of the tank system.
- Monitoring and leak detection data (e.g., level indicators, monitoring wells, or leak detection devices).
- Overfill/spill control equipment.
- Functionality of instruments and controls (e.g., check for deterioration due to heat, moisture, chemical attack or dirt, loose or broken wires and connectors, power on, etc.).

There are inspection logs for daily and weekly inspections included in **Appendix E**. The daily inspection log is for regulated retention systems and can be used to record the information required for documentation of daily inspections of hazardous and mixed waste tank systems, as required by federal and state regulations. A weekly inspection log for nonhazardous retention systems is also included in **Appendix E**. Contact the TAGG Environmental Analyst for copies of the current log to be used. Completed logs and any corrective action documentation must be maintained by the operator for at least three years for each hazardous, radioactive, and mixed waste retention tank in a tank system and must be made available for review by TAGG or regulatory personnel. A TAGG Environmental Analyst will review the inspection forms monthly and inform the operator or the Program if any deficiencies are found. For nonhazardous systems, it is recommended that inspection records be kept and maintained by the Program.

For USTs containing hazardous and mixed waste, the aboveground and visible portions of the tank systems must be inspected each operating day, excluding weekends and holidays. The leak detection monitoring system must remain operational at all times even when the tank is temporarily closed, emptied, and filled with inert material.

Bimonthly, Quarterly, and Yearly Inspections. In addition to the daily and weekly inspections, hazardous, radioactive, and mixed waste retention tank systems must be inspected bimonthly and quarterly to provide a more in-depth check of component soundness and operational capability. (See **Table 2** for inspection frequency required or recommended for different types of retention tank systems.) Bimonthly and quarterly inspections are recommended for nonhazardous retention tank systems as a best management practice. Yearly inspections are not required but are recommended. The bimonthly, quarterly, and yearly inspections are designed to ensure that all equipment and controls are operating properly and that structural integrity of the systems is assured. **Appendix F** is provided as a guide to the minimum inspection tasks and frequencies required for all hazardous, radioactive, and mixed waste wastewater retention tank systems.

As part of the yearly inspections, it is recommended that the operator or the Program perform a system operation check. This system operation check ensures that the system

is being operated correctly, that controls and alarms are functioning as required, and that the system is being maintained properly. The EOG Environmental Analyst or a TAGG Environmental Analyst can assist in the system operation check, if requested by the Program or the operator.

Table 2. Inspection Frequency

Tank Type	Every Operating Day	Every Day (including weekends and holidays)	Weekly	Bi-monthly	Quarterly	Yearly*
Hazardous (with full secondary containment of tank, piping, and major appurtenances)	√			√	√	√
Hazardous (without full secondary containment of tank, piping, and major appurtenances)		√		√	√	√
Mixed (with full secondary containment of tank, piping, and major appurtenances)	√			√	√	√
Mixed (without full secondary containment of tank, piping, and major appurtenances)		√		√	√	√
Radioactive	√			√	√	√
Nonhazardous**			√	√	√	√
Emergency use**					√	√

*Yearly inspections recommended for all retention tank systems.

**Inspections are recommended for nonhazardous and emergency-use tank systems.

Inspection Corrective Action Close-Out Procedures

Any deterioration or malfunction identified during the inspections of hazardous and mixed waste tank systems must be repaired, corrected, or otherwise mitigated by the operator or the Program on a schedule that ensures the problem does not lead to an environmental or human health hazard. This practice is recommended for radioactive and nonhazardous tank systems. If a hazard is imminent or has already occurred, actions to correct the identified problem must be taken as soon as possible.

Close-out practices may include any combination of two approaches—engineered changes or administrative changes. Deficiencies identified during the inspections may be closed immediately with on-the-spot corrective action or over time as a Maintenance or Repair Request (MRR) or as an administrative control.

In all cases, if a deficiency is noted on the daily inspection log, corrective action to close out the problem must be performed in a timely manner and supported by all available documentation.

Operators record deficiencies they observe on the inspection forms and write in an MRR number (if applicable) in the column entitled “Nature of Repairs.” The inspection forms are shown in **Appendix E**. Most deficiencies (e.g., a faded label or a spill) can be corrected on the spot during the inspection, in which case an MRR number will not be necessary.

On-the-spot corrective action is performed on a regular basis for easily correctable inspection deficiencies or problems representing an “imminent hazard.” For on-the-spot corrections, the nature and the date of repairs are recorded.

If the corrective action for a deficiency takes longer to complete, the MRR number should be written on the inspection form. Once the deficiency is corrected, the nature of repairs and the date of completion must be noted on each inspection form where the deficiency was noted. Copies of all MRRs must be kept at the Program. A supervisor must verify completion of the corrective action and the close-out of the deficiency.

Maintenance Program Goals

The goals of an appropriate maintenance program for retention tank systems are to:

- Minimize the probability of accidental releases of wastes.

- Reduce the risks of fire and exposure resulting from such releases.
- Maintain safe working conditions in and around the storage area.
- Permit early detection of potential trouble spots and implement corrective action.
- Maximize the useful life of equipment and minimize costs.

Maintenance

It is the responsibility of the Program to ensure that all components of the retention tank system are properly maintained. This responsibility includes maintaining a log of required maintenance actions, initiating work actions required for proper maintenance, and ensuring that maintenance is performed properly according to a schedule appropriate for the specific equipment.

For new tank systems, the Program is responsible for preparing a maintenance plan as part of the Operational Plan, covering all major system components. The Project Manager is responsible for providing necessary data. A TAGG Environmental Analyst can provide assistance in meeting this requirement.

For existing systems, the Program is responsible for developing a maintenance plan, including maintenance procedures for complex components, such as pumps and leak detection equipment. The tank system operator must record all maintenance actions in a log, and the records made available for periodic review. A sample of a maintenance log form is provided in **Appendix G**.

Prior to scheduling extensive repairs to a hazardous or mixed waste tank system, a Program representative should contact TAGG to determine the need for recertification by a California-registered, professional engineer.

Maintenance Actions

The following maintenance actions may be required, depending on the system design and the equipment manufacturer:

- Pumps — Lubricate bearings monthly, and replace seals and shaft bearings yearly.
- Valves — Replace seals yearly.
- Steel structures — Repaint every two years (or sooner if inspections indicate corrosion).
- Aboveground piping — Repaint or recoat every two years (or sooner if inspections indicate corrosion or ultraviolet deterioration).
- Coating in secondary containment berm — Recoat every two years (or sooner if significant cracks appear).

Wastewater Disposal

Release of wastewater from retention tank systems to the sanitary sewer is strictly controlled. Wastewater can be released to the sanitary sewer system only after the discharge has been properly authorized by ORAD.

No discharge may be made from any retention tank until the contents of the tank have been sampled, analyzed, and approved for discharge by ORAD. Based on the results of the analysis, ORAD's WGMG RP (or designee), following established criteria, will categorize the contents as:

- Nonsanitary sewerable.
- Nonhazardous waste that is sewerable following pH adjustment.
- Sewerable without neutralization.

Refer to *Guidelines for Discharges to the Sanitary Sewer System*[3] for detailed information on this subject.

Sampling. Prior to sampling, the contents of the retention tank must be thoroughly mixed to ensure that the contents are homogeneous and that settled sludge is resuspended. Mixing can be accomplished using the pump installed in the system, a portable pump, an air sparger, or a mechanical mixer. The time required to circulate the retention tank contents depends on the size and the configuration of the tank and the method of mixing used. Contact a TAGG Environmental Analyst for assistance in determining proper mixing requirements for each tank.

The TAGG Environmental Analyst assigned to support the Program will work with Program personnel to determine which analyses must be performed on the samples, based on information from the Program on the processes that produced the waste. Once the tank is mixed, a HWM Field Tech (or other responsible and trained employee arranged through special agreement) takes a representative sample of the tank contents and delivers it to the designated laboratory for the specified analyses. The results of the analyses are forwarded to the WGMG RP or designee, who reviews the results and determines whether the contents may be released to the sanitary sewer. The WGMG RP then notifies the tank operator that the results are available.

Disposal. If the WGMG RP or designee determines that the contents are sanitary sewerable, the contents may be released to the sanitary sewer. If contents are nonhazardous and nonradioactive but are outside the sanitary sewer limits for pH, the operator can contact HWM Division to perform a pH adjustment at the tank site. If the contents are not

sanitary sewerable, the HWM Division must be contacted by the operator to arrange for a pump-out and the disposal of the contents. In any case, before discharging the wastewater, the contents must be thoroughly mixed to ensure that residual sludge is minimized by resuspension in the matrix.

A Summary of Responsibilities for the Operation and Maintenance of Retention Tank Systems

The **Program** is responsible for ensuring that the discharged wastewater is compatible with the tank system. Ensuring compatibility with the tank system requires the Program to perform periodic review of all discharges. The Program is also responsible for ensuring proper operation and maintenance of all components and for ensuring that an operator and backup are assigned and properly trained.

The **operato**r is responsible for ensuring that the system is operated safely and maintained properly; that daily inspections are conducted, if appropriate; that records of the inspections and maintenance activity are maintained; and that corrective action is initiated, and its completion is closed out on inspection logs.

The **EOG Environmental Analyst** assigned to support the Program assists with the recommended annual tank system inspection and works with Program personnel to determine the analyses to be performed on samples.

The **TAGG Technologist** performs monthly reviews of the daily inspection logs and can assist in the recommended yearly system operation check.

The **HWM Field Technician** or other responsible and trained employee is responsible for sampling and delivering the samples to the designated laboratories.

The **WGMG RP** is responsible for approving wastewater for discharge based on established LLNL criteria and permitted discharge limits.

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Leak Monitoring

Leak detection and monitoring are vital to determining whether a release has occurred so that releases to the environment can be prevented or minimized. The use of a leak detection system in the interstitial space allows for detection of leaks from the primary containment while a secondary barrier still remains to contain releases before they enter the environment.

Regulations for hazardous waste tanks require that a leak monitoring system be "designed and operated so that it will detect the failure of either the primary and secondary containment structure or any release of hazardous waste or accumulated liquid in the secondary containment system within 24 hours" (40 CFR 264.193[c][3], 40 CFR 265.193[c][3],[9] 22 CCR 66264.193[c][3], 22 CCR 66265.193[c][3]).[10] Therefore, if a continuous leak detection system is not operational on a hazardous or mixed wastewater retention system, then the secondary containment must be checked for spills, leaks, or rainwater accumulation at least once every day, including holidays and weekends. See **Appendix H** for information on handling rainwater in secondary containment and for release forms. There is a form for releasing rainwater from hazardous or mixed waste tank systems, and another form for releasing rainwater from nonhazardous or radioactive tank systems.

Leak Monitoring Program

Retention tank systems that are subject to California UST regulations must have a leak monitoring program that includes a written Monitoring and Leak Response Plan. All monitoring programs must include visual monitoring of aboveground portions of retention tank systems where feasible. For underground portions, or where visual monitoring is not feasible (such as at the bottom of a tank in contact with a pad), an alternative monitoring method must be employed. For new, double-walled systems, continuous monitoring of the interstitial spaces between the primary and secondary containment must be used. For existing tanks subject to the California UST regulations, various monitoring alternatives are available. Contact TAGG for assistance in determining the appropriate monitoring alternative.

The leak response portion of the Plan must describe how to respond to an alarm or other indication of a release. This Plan should provide a procedure for determining whether the alarm is valid, determining the location of the leak, ceasing tank operations, and removing tank contents. It should list the steps required to bring the system back into service.

The monitoring program must be described in any permit application, and it must be approved by the appropriate County before a permit will be issued. TAGG has developed a template of the Monitoring and Leak Response Plan. Contact your TAGG Environmental Analyst who will assist in the completion of the Plan. A TAGG Environmental Analyst will submit the required permit applications and provide guidance on the leak monitoring program.

Leak Testing

When a leak test is required, several methods are available, such as hydrostatic testing, air pressurization, helium leak detection, and precision testing. If all surfaces of the primary container (tank and/or piping) are visible, a visual leak test may be appropriate. Any leak-test method that is used must be appropriate for the system and the components being tested and meet any applicable regulations. USTs that are regulated by California regulations must be leak-tested by a method approved by the State Water Resources Control Board and performed by a state-certified tester. Contact TAGG for assistance in determining an appropriate test method for all leak tests.

Unique conditions of retention tank systems that may present difficulties in testing include the nature of the contents (e.g., corrosive or radioactive), a tank configuration that is greatly different from those of standard petroleum tanks, and a large surface area resulting in wave action.

Precision tests may be used as part of the monitoring program for UST retention tank systems. Precision testing may also be required to verify the existence and location of a leak when leak detection equipment has activated an alarm.

TAGG develops a test schedule with Program concurrence, provides test personnel, and submits the required reports as a service to the Programs to help them remain in compliance with UST regulations.

At times, water must be added to the retention tanks and the associated piping to facilitate testing. As the generator of the waste, the Program is responsible for any appropriate analysis and disposal of the wastewater, including any water that was added for testing and any contaminated test supplies (e.g., gloves).

Prior to leak testing, a swipe sample may be collected to screen for gross alpha, gross beta, and pH to ensure that insertion of equipment into the tank will not result in contaminated testing equipment. A HWM Field Tech will perform necessary swipe samples of hazardous substances when needed. Hazards Control representatives will determine and perform swipe sampling of radioactive substances when needed.

Leak Detection Follow-Up

When leak detection equipment, visual monitoring, or a leak test indicates that a leak or spill has occurred, a series of follow-up steps must be taken. These steps are structured to provide the appropriate actions to (1) minimize any environmental impact and (2) determine a course of action to remedy the leak or spill. The procedures below are provided to show the required actions to be initiated by ORAD, the operator, or the Program after the detection of a leak in a retention tank system.

If a leak or spill is detected by **leak detection equipment**, the operator:

1. Checks for leak detection equipment malfunction.
2. Ceases operation of the tank.
3. Visually checks for the leak, if possible.
4. Determines whether material has entered the environment.
5. Initiates appropriate spill response.
6. Removes the wastewater from the tank and/or secondary containment within 24 hours (required for hazardous or mixed waste only) and initiates actions to stop material from entering the environment.
7. Immediately contacts an EOG Environmental Analyst in ORAD during normal working hours (or the Environmental Duty Officer [EDO] in EPD during off hours) for assistance in reporting releases to the environment to the appropriate regulatory agencies. **Note:** Only releases that have entered the environment are to be reported.

For reportable leaks or spills, ORAD:

8. Contacts the Program first in accordance with occurrence reporting requirements.
9. Reports releases to the environment to appropriate regulatory agencies within 24 hours of leak detection and submits a written report within 30 days (for hazardous or mixed waste only). **Note:** For leaks from hazardous or mixed waste USTs, an additional report must be made within five days of leak detection to the appropriate regulatory agencies.
10. A TAGG Technologist from ORAD arranges for a precision test to verify and locate the leak. TAGG uses a hydrostatic test, helium leak test, or other test, if needed, to locate the leak.
11. TAGG determines whether soil remediation is required.
12. The Program decides whether to repair or close the tank.
13. If extensive repairs are made to a hazardous or mixed waste retention system, the tank may need to be certified by a California-registered, professional engineer.
14. For hazardous and mixed waste retention systems, if the leak or spill originated from ancillary equipment without secondary containment, unless the integrity of those parts can be checked visually, secondary containment will have to be provided for those parts prior to putting the system back in service.

If a spill or leak is detected by a **leak test** or by **visual monitoring:**

1. After an inconclusive test result, a TAGG Technologist arranges for a confirmatory leak test by a state-certified tank tester.

The operator:

2. Ceases operation of the tank.
3. Initiates spill response.
4. Removes the wastewater from the tank and/or secondary containment within 24 hours (for hazardous or mixed waste only) and initiates actions to stop the material from entering the environment.

For reportable spills or leaks, ORAD:

5. Contacts the Program first in accordance with occurrence reporting protocol.
6. Reports any releases to the environment to the appropriate regulatory agencies within 24 hours of leak detection and submits a written report within 30 days (for hazardous or mixed waste only). **Note:** For leaks from hazardous or mixed waste USTs, an additional report must be made within five days of leak detection to the appropriate regulatory agencies.
7. A TAGG Environmental Analyst from ORAD locates the leak (use hydrostatic testing, helium leak detection, or alternative methods, if needed).
8. TAGG determines whether soil remediation is required.
9. The Program repairs or closes the tank.
10. If extensive repairs are made to a hazardous or mixed waste retention system, the tank may need to be certified by a California-registered, professional engineer.
11. For hazardous and mixed waste retention systems, if the leak or spill originated from ancillary equipment without secondary containment, unless the integrity can be checked visually, secondary containment will have to be provided for those parts prior to putting the system back in service.

The flowchart in **Figure 2** shows the responsible parties and the actions required to follow up after a leak is detected by a leak test of the retention tank system. This flowchart represents the typical scenario although tank systems are unique and must be handled on a case-by-case basis.

When **historical contamination** has been found that requires remediation, ERD will normally be the responsible party. When current operations are determined to be the cause of contamination, TAGG in ORAD will normally be responsible for coordinating follow-up actions unless other arrangements are made. Depending on the type and extent of the leak, considerable time may be required to investigate the leak, make repairs, perform any necessary remediation and certifications, and retest the system before the tank system can be returned to service. Some actions, such as repairs, may also require regulatory agency approval before the tank system can be used again.

Documentation of repairs for hazardous and mixed waste retention tanks must be recorded and maintained for five years by the Program. This procedure is also recommended for radioactive and nonhazardous tanks as a best management practice. Contact TAGG for specific and current requirements and procedures.

A Summary of Responsibilities for Leak Detection/Monitoring

The **Program** implements a Monitoring and Leak Response Plan with guidance and assistance from **TAGG**.

The **EOG Environmental Analyst** assigned to support the Program can also provide guidance and assistance in implementing a Monitoring and Spill Response Plan.

As part of spill or leak detection or release follow-up, the **Program** is responsible for submitting an occurrence report to DOE (if required); removing the retention tank system from service; and, if necessary, repairing or closing the tank system.

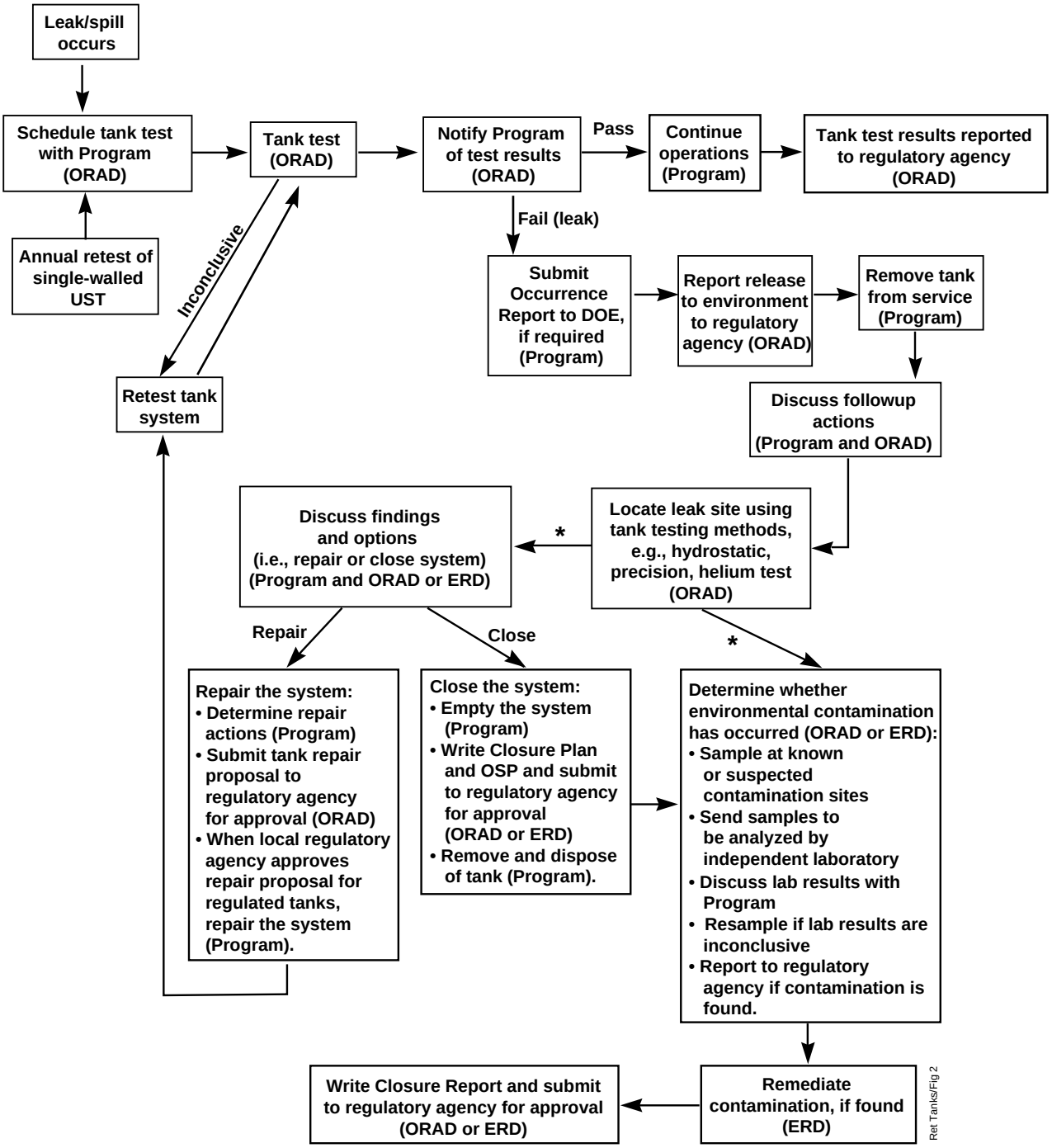
TAGG works with the responsible Program to:

- Coordinate, compile data, and provide yearly reports, when required, to regulatory agencies on monitoring programs for retention tanks.
- Provide notification of leaks to regulatory agencies, including follow-up leak reports.
- Provide tank testing services (1) as required by regulations for system monitoring and leak detection, and (2) to ensure system integrity to prevent releases of wastewater to the environment.

ORAD provides test personnel, submits the required reports, and is responsible for initiating release detection follow-up.

ERD is responsible for environmental clean-up and closure of a tank system that has caused historical environmental contamination.

The **Program** is responsible for the cost of environmental clean-up and closure of a tank system that has caused recent contamination.



DOE = U.S. Department of Energy
ERD = Environmental Restoration Division
ORAD = Operations and Regulatory Affairs Division
UST = Underground storage tank
*** These two actions are conducted concurrently.**

Figure 2. Responsible parties (identified in parentheses) and follow-up actions required after a spill or leak is detected.

Spill Control

An accidental spill of wastewater could result in an unauthorized release to the stormwater sewer, sanitary sewer, or to the soil and groundwater—all of which could involve costly clean-up and restoration. Employees involved in the operation of retention tank systems are responsible for knowing how to prevent spills and, if a release should occur, how to control the spill to prevent or minimize its impact on human health and the environment. Having a properly designed and maintained retention tank system is the most effective way of preventing releases of wastewater to the environment. Planning for prevention is the first step in effective spill control.

Spill Prevention

The design of new retention tank systems must consider the toxicity of the wastewater that might be contained and provide appropriate spill and overfill protection features. In this design of a system, care should be given to selecting materials that will ensure compatibility with the stored substance, providing appropriate safety devices (such as high-level alarms and automatic pump shut-offs), and ensuring that the system controls are arranged to monitor system operation and to provide optimum personnel safety.

When a system is in use, proper procedures must be followed to minimize spills that might occur from operator error. Extra precautions must be taken during such operations as transfers from tank to tank. These precautions might involve ensuring that:

- Two people are always involved (the "buddy system").
- Spill containment materials are within easy access.
- Monitoring equipment is functioning properly.

Other ways to prevent spills from occurring include ensuring that deficiencies with system components are reported and corrected promptly, that maintenance is performed on schedule, and that proper safety procedures are followed.

It is the responsibility of the operator to be entirely familiar with the design and operation of the retention tank system. This person must be knowledgeable about the operation of the leak detection equipment and the normal tank retention system so that problems can be quickly identified. The operator must also be well versed on proper valve alignments so that pumping operations do not result in inadvertent discharges of wastewater. TAGG should be notified if questions arise on proper system operation in relation to environmental regulations.

Spill Response

The primary aims of spill response must be to protect human health and the environment. LLNL separates spills (or environmental incidents) into two categories: "small" and "large."

Small spills are defined as (1) the release of material whose nature and potential hazards are known; (2) the release presents no actual or potential threat to human health or the environment; (3) the release can be cleaned up by one or two people in less than one hour; and (4) the release results in no more than minor injury requiring simple first aid.

A large spill involves (1) the potential contamination of soil or groundwater, or (2) a fire or an explosion.

A large spill is (1) unsafe to manage without LLNL Fire Department assistance; (2) the type of material released is unknown; (3) it cannot be cleaned up by two people in less than one hour; (4) injuries require more than simple first aid; and (5) the release migrates to the soil, stormwater drain, or the sanitary sewer system. If there is any doubt as to the proper spill response, contact the Fire Department immediately by calling 911 for either the Livermore site or Site 300. For spills or leaks only to the secondary containment, the spill response must include a determination of the origin of the spill and may require leak testing the tank system.

After a rain storm, rainwater that collects in a secondary containment structure must be handled as a "spill" until it can be determined that the liquid is only rainwater. Upon the discovery of liquid thought to be rainwater in a secondary containment structure, the operator must perform a thorough inspection of the system to help determine whether the liquid is rainwater or is the result of a spill from the tank system. See **Appendix H** for information on handling rainwater in secondary containment and for release forms. There is a form for releasing rainwater from hazardous or mixed waste tank systems, and another form for releasing rainwater from nonhazardous or radioactive tank systems.

If hazardous or radioactive material is spilled or discharged to a retention tank system that has been designed and/or operated as a nonhazardous wastewater retention tank, the steps below must be taken.

The operator must:

1. Cease operations discharging to the retention tank.
2. Immediately notify the EOG Environmental Analyst.

3. If the spill or discharge is of significant quantity, or meets the large-spill criteria, or presents a potential hazard to personnel in the area, immediately notify the LLNL Fire Department at 911 or call 447-6880 if using a cellular phone.
4. Verify that no release to the environment has occurred.
5. Have the retention tank contents analyzed for the concentration of hazardous or radioactive waste, and dispose of the wastewater as appropriate.
6. Determine the source of the spill and whether it was a one-time accident or due to a change in the waste stream.

   Note: If the waste stream has changed, causing the wastewater to be classified as hazardous, radioactive, or mixed waste, the classification of the retention tank system must be changed. This change requires that the appropriate regulatory agency be notified and the tank be permitted if it stores hazardous or mixed waste. The retention tank system must be shut down until an engineering assessment is completed and the system is tested and verified as leak-tight. Only when these steps have been completed can the system be returned to use.
7. If the spill was a one-time accident and the wastewater was hazardous, radioactive, or mixed waste, the tank must be decontaminated by appropriate means (such as steam cleaning, triple rinsing, etc.) to return the tank to operation as a nonhazardous system. Administrative and/or engineering controls must be instituted to prevent a recurrence. In other words, a nonhazardous tank that has received hazardous or mixed waste must first be emptied and decontaminated so that regulatory requirements can be satisfied.
8. If repairs are needed, additional requirements may apply regarding inspections and upgrading of system components. An Environmental Analyst from TAGG or EOG should be contacted for further assistance.

A Summary of Responsibilities for Spill Control

The **operator** is responsible for complete familiarity with system design and operation to prevent inadvertent spills, discharges, and releases to the environment. The operator must be able to identify problems rapidly.

The **LLNL Fire Department** is responsible for providing emergency response to large environmental incidents. The Fire Department specifies appropriate response and is assisted by the Program and the ES&H Team.

The **EOG Environmental Analyst** or the **EDO** and the **TAGG Environmental Analyst** are responsible for assisting with spill response and for identifying regulatory requirements following a release to the environment.

CAUTION:

If a release occurs from a hazardous, radioactive, or mixed waste retention tank system, operations must *immediately* cease discharging to the tank, the tank must be emptied immediately according to the tank Operational Plan, and spill response procedures must be initiated.

Repair or Closure

After a leak or spill has been mitigated, the Program must decide, with guidance from EPD and Hazards Control, to either repair or close the retention tank system. If the cause of the spill did not involve damage to the integrity of the system, the tank system may be returned to service after the waste is removed and repairs (if necessary) are completed. If a leak is detected between the primary and secondary containment structure, the waste must be removed, repairs made, and the repaired portions tested before that tank may be returned to service. If a release occurs to the environment from a component without secondary containment, secondary containment may have to be added. If a leak occurs in an underground or inaccessible portion of a tank system, the entire component must be upgraded to include secondary containment. If the regulatory requirements cannot be met, the tank system will have to be closed.

Tank System Repair

Replacement tank system components are considered new components, which means they must comply with all requirements for construction. If the repairs are extensive (e.g., installation of an internal liner or the repair of a ruptured primary or secondary containment vessel), an independent, qualified, California-registered, professional engineer must certify that the repaired system can safely handle hazardous, radioactive, or mixed waste for the intended life of the system. Certification is not needed for

minor, routine maintenance and repairs (e.g., valves, seals, pumps, instrument adjustments, etc.).

State regulations require that a Closure/Modification Plan be submitted and approved before major repairs can be undertaken for USTs storing hazardous waste. After repairs are completed, a leak test must be performed to ensure that repairs were completed satisfactorily and the system is leak-tight. Documentation of repairs to hazardous and mixed waste tank systems must be kept on file for five years. This is recommended for nonhazardous and radioactive waste tanks.

Tank System Closure

Temporarily Inactive, Out-of-Service Tanks

A Program may, on occasion, remove a tank system temporarily from service or inactivate it. The tank owner intends, however, to use the tank again and does not intend either formal temporary or permanent closure. Under these circumstances when no formal, approved temporary Closure Plan is in place, certain requirements for shutdown, surveillance, and maintenance still apply. To be considered out of service, all aboveground tanks and ancillary equipment which California classifies as hazardous must be emptied. All waste is removed, and no liquids or sludges are visible although stains or scaly residues may be present. The tank may or may not be decontaminated.

Inactive, out-of-service tanks, ancillary equipment, and the secondary containment system of hazardous and mixed waste retention tanks must still be inspected daily, and the inspections documented as if the tanks were in service. Continued daily inspection of radioactive wastewater retention tanks and weekly inspection of nonhazardous wastewater retention tanks are also recommended. Refer to the *LLNL Health and Safety Manual*, Supplement 2.10[11] for specific LLNL and DOE requirements.

Inactive, out-of-service tanks must be returned to service within 12 months. If not, the tank owner must initiate either temporary or permanent closure procedures.

Formal Temporary Tank Closure

A tank owner may initiate temporary closure procedures for tank systems that are to be removed from service (i.e., wastewater storage has ceased) for less than 12 months before being returned to service. USTs that have experienced an unauthorized release do not qualify for temporary closure until the appropriate, authorized repairs have been made. Requirements for temporary closure include:

- All liquid, solids, or sludges from the tank, including all waste residues, must be removed.
- All fill and access locations and piping (except vent lines) must be sealed.
- The tank must be inspected once every three months, and the inspection documented.

All aboveground tanks and ancillary equipment are empty per federal regulations if liquids or sludges that are present are below the level of the drain pipe. That is, the tank has been drained, but it has not been rinsed or has not been rinsed sufficiently to remove all waste residues, and it is intended for reuse within one year.

If secondary containment is present, a daily inspection of a tank and ancillary equipment that are not in use is not required. The secondary containment system must be checked for leakage at least once every 24 hours, or a continuous leak detection system must be in operation. The status of the tank must be documented in a Daily Inspection Record. For further details on formal temporary closure requirements, contact TAGG.

Permanent Tank Closure

If the Program decides to close a hazardous, radioactive, or mixed wastewater retention tank system permanently because of the costs of repairing the system or because the system is no longer needed, formal closure action must be initiated. Notify the TAGG Environmental Analyst immediately to ensure that the closure is coordinated with regulatory agencies. Direction from regulators and prudent management dictate that all tanks being closed permanently be removed and disposed of unless the conditions require that the tank or piping be "closed in place." In cases where tanks or piping are contained within a building or are immediately adjacent to a building foundation where the removal would jeopardize or adversely affect the structural integrity of the building, tanks may be closed and left in place. Any proposal to "close-in-place" a hazardous or mixed waste tank system or any portion of it, including its piping, must be approved by the regulating agency. For hazardous and mixed wastewater retention tanks, the regulatory agency must be notified a minimum of 90 days after cessation of storage to the closure application. Once approval to close the tank is granted, the tank must be closed within 180 days, or an extension from the regulatory agency will be required.

Closure Activities

TAGG (or ERD if remediation is involved) will coordinate all closure activities, including the following:

- Writing the Closure Plan.
- Writing the Operational Safety Procedure (OSP)/Site Health and Safety Plan (SHASP) required for removing the tank system, if required.
- Coordinating activities with regulators (county, state, or the EPA).

- Arranging for disposal of the tank and its contents.
- Taking soil samples after tank removal and having the samples analyzed. (If contamination is found at this time, further responsibility may be transferred to ERD for remedial investigation if the contamination is due to a historical spill.)
- Writing Quarterly Status reports for tanks that have been shown to have leaked.
- Writing the Closure Report after removal activities have been completed.

Appendix I provides a checklist for TAGG or the ERD closure coordinator to identify activities required to be completed for UST closures. This checklist is provided as a guide only. Contact TAGG for specific and current requirements and procedures for retention tank closures.

For nonhazardous tanks, LLNL policy requires the same closure process to be followed except that the closure documentation will be kept on file and not submitted to any regulatory agency. This policy ensures that adequate documentation exists to demonstrate that proper procedures were followed in case of subsequent questions or concerns from regulators.

If a tank is permitted to store hazardous waste for longer than 90 days, or if it is a radioactive waste or mixed wastewater storage tank, then additional requirements apply that add greatly to the procedures and documentation required for closure. In these cases, the EOG Environmental Analyst or TAGG Environmental Analyst should be contacted for additional information. For tanks permitted to store hazardous waste longer than 90 days, the Permits and Regulatory Affairs Group (PRAG) of ORAD will also be involved.

A Summary of Responsibilities for Tank System Repair and Closure

TAGG prepares documentation required for tank repairs or closure and coordinates tank closure and removal operations. (**ERD** may perform this function for tank systems requiring remediation.)

The **Program** is responsible for deciding to repair or close a tank after a leak or spill. The Program must document the repairs and maintain the documentation on file for the appropriate retention period. The Program is responsible for notifying the TAGG Environmental Analyst when a tank system is to be closed and is responsible for closure costs.

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8. Lawrence Livermore National Laboratory (1993), *Guidelines for Permitting Air Emission Sources*, Lawrence Livermore National Laboratory, Livermore, CA (UCAR-10236).

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11. Lawrence Livermore National Laboratory (1991), *LLNL Health and Safety Manual*, Supplement 2.10, "Shutdown, Surveillance, and Maintenance Requirements for Inactive Facilities, Equipment, and Experiments," Lawrence Livermore National Laboratory, Livermore, CA (UCRL-MA-106166).

12. *California Code of Regulations*, Title 22, Section 66693, "Applicability of Hazardous Waste Criteria," (22 CCR 66693).

13. *Code of Federal Regulations*, Title 40, Part 261, "Identification and Listing of Hazardous Waste," (40 CFR 261).

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16. *Code of Federal Regulations*, Title 40, Part 262, "Standards Applicable to Generators of Hazardous Waste," (40 CFR 262).

17. *Code of Federal Regulations*, Title 40, Part 265.191, "Assessment of Existing Tank System's Integrity," (40 CFR 265.191).

18. *Code of Federal Regulations*, Title 40, Part 112, "Oil Pollution Prevention," (40 CFR 112).

19. *California Code of Regulations*, Title 23, Division 3, Chapter 16, "Underground Tank Regulations," (23 CCR 16).

20. *California Code of Regulations*, Title 22, Section 66262.34, "Accumulation Time," (22 CCR 66262.34).

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25. *Code of Federal Regulations*, Title 40, Part 280.70, "Temporary Closure," (40 CFR 280.70).

26. *California Code of Regulations*, Title 22, Section 66265.191 (22 CCR 66265.191).

Appendix A

Acronyms and Glossary

Aboveground tank — A device meeting the definition of "tank" that is situated in such a way that the entire surface area of the tank is completely above the plane of the adjacent surrounding surface, and the entire surface area of the tank (including the tank bottom) can be visually inspected. For the purposes of this document, the definition of "aboveground tank" also includes "onground tanks," which are tanks situated in such a way that the bottom of the tank is in contact with the ground or slab, thus preventing visual inspection of the tank bottom. Onground tanks should be raised, at a minimum, by placement on plastic mats or other grating device to allow draining of bottom leaks to the low spot in the secondary containment.

AD — Associate Directors. See *Program.*

ALARA — As Low As Reasonably Achievable.

Ancillary equipment — Devices (including, but not limited to, piping, fittings, flanges, valves, and pumps) connected to the retention system used to distribute, meter, or control the flow of wastewater from its point of generation to storage or treatment tank(s), between waste storage and treatment tanks to a point of disposal onsite, or to a point of shipment for disposal offsite.

Bay Area Air Quality Management District (BAAQMD) — The local regulatory agency that oversees compliance with state air quality requirements.

BMP — Best management practices.

CCR — *California Code of Regulations.*

CEQA — California Environmental Quality Act.

Certification — A signed statement of professional opinion based upon knowledge and belief.

CFR — *Code of Federal Regulations.*

Closed in place — The practice of leaving a tank and/or piping in place, such as underground, after it is removed from service and officially closed. The practice involves removing any contamination from the tank and any associated piping left in place, filling the tank with an inert material (such as concrete), sampling underneath the tank for possible contamination of the soil, and possibly providing long-term monitoring of the tank site by new or existing groundwater or vadose-zone monitoring wells.

Closure — The process by which a tank is taken out of service (removed if possible) and decontaminated (if required), the surrounding soil is analyzed for contamination, and any required remediation is identified. For regulated underground storage tanks, this process requires that a Closure Plan be prepared and submitted to the appropriate County agency for approval prior to commencement of closure activities. For aboveground hazardous or mixed wastewater tanks, all documentation of closure activities must be retained and copies forwarded to the Tank Assessments and Guidance Group (TAGG).

Component — The tank or any ancillary equipment of the tank system.

Corrosion expert — A possessor of thorough knowledge of the physical sciences and the principles of engineering and mathematics acquired by a professional education and related practical experience and who is qualified to engage in the practice of corrosion control on buried or submerged metal piping systems and metal storage tanks. Such a person must be certified by the National Association of Corrosion Engineers or must be a registered professional engineer who has certification or licensing that includes education and experience in corrosion control on buried or submerged metal piping systems and metal tanks.

Daily — For hazardous waste tank systems with full secondary containment, "daily" means once per day for every day that the facility is normally open for business, or every day the Program is operating equipment that produces waste and introduces that waste to the retention tank system.

Note: For hazardous tank systems without full secondary containment, "daily" means once per day every day whether or not the facility is open for business. This definition of "daily" includes weekends and holidays.

DOE — U.S. Department of Energy.

DTSC — California Department of Toxic Substances Control.

EDO — The Environmental Duty Officer is an Environmental Analyst from the Environmental Protection Department (EPD) who is assigned and required to respond to and provide guidance on all environmental incidents 24 hours a day, including holidays and weekends.

EIR — Environmental Impact Report.

EIS — Environmental Impact Statement.

Empty tank — What can practically be pumped out during normal operating condition. After pumping, the tank is considered empty by federal regulatory definition even though waste residues may be present.

EOG Environmental Analyst — As used in this document, a member of the Environmental Operations Group (EOG) of the Operations and Regulatory Affairs Division (ORAD) who is assigned to a particular Environmental, Safety, and Health (ES&H) Team to provide guidance to the Programs on environmental issues. As a member of the ES&H Team, the EOG Environmental Analyst will forward the tank projects needing environmental regulation compliance review to TAGG, may help coordinate the review and tracking of tank project activities with TAGG, and may act as the contact between Program and EPD personnel.

EPA — U.S. Environmental Protection Agency. An informational summary of environmental regulations pertaining to tanks is included in **Appendix B**.

EPD — The Environmental Protection Department at Lawrence Livermore National Laboratory (LLNL). A summary of the roles and responsibilities of EPD units is included in **Appendix C**.

ERD — Environmental Restoration Division in EPD.

ES&H Teams — Environmental, Safety, and Health Teams consist of members assigned from the Plant Operations Directorate to support Programs in environmental, safety, and health issues.

Hazards Control — The LLNL department responsible for health and safety issues and compliance onsite.

Hazardous wastewater — Wastewater that contains hazardous waste constituents as defined by 22 CCR 66693[12] and 40 CFR 261.[13] Generally, hazardous waste exhibits any of the following characteristics: ignitability, corrosivity, reactivity, or toxicity. Toxicity must be reviewed by the DTSC's Waste Extraction Test Procedures as well as the EPA's Toxicity Characteristic Leaching Procedure (TCLP). In addition, the DTSC and the EPA have listed as hazardous other wastes that do not necessarily exhibit these characteristics. State and federal hazardous waste regulations set strict controls on the management of hazardous wastewater.

H&S Tech — A Health and Safety Technologist is a member of the ES&H Team assigned to a Program. A H&S Tech can perform the duties related to retention tank systems.

HWM — Hazardous Waste Management Division in EPD.

HWM Field Technician (HWM Field Tech) — A HWM Division staff member whose duties include supporting a Program in the operation of retention tanks by assisting with the management of hazardous or potentially hazardous wastewater. Duties related to retention tank systems that are performed by the HWM Field Tech can also be performed by the H&S Tech who is a member of the ES&H Team assigned to a Program.

In use — The tank system is storing product or waste. Once product or hazardous or mixed waste is added to the system, daily inspections must commence.

Incompatible waste — A hazardous waste that is: (1) unsuitable for placement in a particular device or facility because it may cause corrosion or decay of containment materials (e.g., container inner liners or tank walls); or (2) unsuitable for commingling with another waste or material under uncontrolled conditions because the commingling might produce heat or pressure, fire or explosion, violent reaction, toxic dusts, mists, fumes or gases, or flammable fumes or gases.

Installation inspector — A possessor of knowledge of the physical sciences and the principles of engineering that were acquired by a professional education and related practical experience, and/or regulatory mandate and who

is qualified to supervise the construction and installation of tank systems.

Interstitial space — The space between the primary and secondary containment systems.

Leak detection system — A system capable of discovering or determining either a failure of the primary or secondary containment structure or the presence of liquid or waste in the secondary containment structure. Such a system can be used to preclude spill and leak inspections for hazardous or mixed waste tank systems on weekends and holidays if it can detect the presence of leaked waste and notify an operations center so that staff responds within 24 hours.

Leak tight — A state environmental tank regulation phrase that means no leak in excess of 0.05 gallons per hour.

LLNL — Lawrence Livermore National Laboratory (Livermore Site and Site 300).

Mixed wastewater — Wastewater that meets the criteria for hazardous wastewater and radioactive wastewater.

MRR — Maintenance Request or Repair.

MSDS — Material Safety Data Sheet.

NEPA — National Environmental Policy Act. Retention tank systems that are upgraded or closed may require NEPA actions.

Nonhazardous wastewater — Wastewater that does not meet any of the criteria for hazardous waste or radioactive waste but may be nonsewerable (i.e., contain constituents above LLNL's sanitary sewer discharge limits).

Operator — A person (or persons) responsible for day-to-day operation of a retention tank system. Different functions of operation (sampling, discharging, inspections, etc.) may be performed by different people as assigned by the responsible Program. It is the responsibility of the Program to assign an operator(s) and backup operator(s) with responsibility for operation, inspection, and maintenance of the tank system. This person (or persons) may be the Hazards Control Department's H&S Tech assigned by the appropriate ES&H Team, a HWM Field Technician, or a Program representative upon agreement between the respective parties.

Operating day — Each day the tank is in use, i.e., every day that the tank is storing waste while research, manufacturing, or other programmatic activities are being conducted. "Operating day" includes weekends and holidays only if such functions are active on those days. If the tank has a secondary containment and a leak detection system, weekends and holiday inspections are generally excluded.

ORAD — Operations and Regulatory Affairs Division in EPD.

OSHA — Occupational Safety and Health Administration.

OSP — Operational Safety Procedure.

Overfill protection — Equipment or design features intended to prevent releases of wastewater resulting from the overfilling of primary tanks.

P&ID — Piping and instrumentation diagram.

PRAG — The Permits and Regulatory Affairs Group in ORAD.

Program — Refers to LLNL programs, operations, and support groups that may generate wastewater that must be temporarily stored in a tank prior to its disposal or discharge to the sanitary sewer. The Facility Manager is the tank "owner." Where existing tank systems have multiple ADs involved, it is the responsibility of the Programs involved to determine the "owner." As used in this document, "Program" also refers to the organization that is responsible for the design and/or operation of a retention tank system.

Pump-up station — Pump-up station refers to a small, self-contained, vendor-supplied, tank-and-pump package located within a building. The pump-up station normally takes wastewater from sink drains (or process discharge) and automatically pumps it to an aboveground retention tank located outside the building for storage.

Radioactive wastewater — Wastewater that contains radioactive waste subject to the Atomic Energy Act and shows analytical results (for a representative sample analyzed for gross alpha, gross beta, tritium, or gamma) that are above LLNL's internal sanitary sewer discharge limits. New retention tank systems are classified as "radioactive" if they are installed to contain wastewater with the potential for radioactive contamination, i.e., if they are installed to contain wastewater from Radioactive Material Management Areas (RMMAs). Existing systems are classified as "radioactive" if they

are installed in current RMMAs or if the system has serviced a RMMA in the past and has not been decontaminated below limits specified by DOE Order 5400.5[14] for removable and fixed contamination. LLNL typically does not have high-level radioactive waste storage tanks.

RCRA — Resource Conservation and Recovery Act.

RCRA hazardous waste — A hazardous waste as defined in 40 CFR 261.3.

Retention tank system — A wastewater storage tank and its associated ancillary equipment and containment system. This system includes all piping carrying the wastewater from the entry point (e.g., sinks, floors drains, etc.) to the tank(s).

RMMA — Radioactive Material Management Area.

RP — Responsible Person. A designation used by the Water Guidance and Management Group.

SARA — Superfund Amendments and Reauthorization Act.

Secondary containment — External containment to prevent leaks from the primary containment from entering the environment. Examples of secondary containment include the outer shell of a double-walled tank or pipe; the coated, concrete trench for piping; the coated, concrete vault; and the coated, concrete pad and berm.

Sewer discharge limits — A set of threshold concentration values for specified organic, inorganic, and radioactive constituents as specified by LLNL, the City of Livermore, the federal or state government, or the DOE for discharges to the sanitary sewer system.

SHASP — Site Health and Safety Plan.

Sludge — Any material that has settled out from a mixture of a solid and liquid and does not contain freeflowing liquid.

SPCC — Spill Prevention Control and Countermeasures.

State Water Resources Control Board — The California regulatory agency responsible for the enforcement of Title 23 of the *California Code of Regulations.*

TAGG — Tank Assessments and Guidance Group in ORAD.

TAGG Environmental Analysts — Refers to the individuals who support the Environmental Support teams and who are responsible for providing guidance on regulatory requirements, design requirements, and closure documentation on all LLNL retention tank systems.

TAMM — Refers to the Terrestrial and Atmospheric Monitoring and Modeling Group in ORAD.

Tank — A stationary device that is designed to contain an accumulation of wastewater, that is constructed primarily of nonearthen materials (e.g., wood, concrete, steel, or plastic), and that provides structural support. Discussion of tanks in this document is limited to retention tanks; petroleum- and chemical-product storage tanks are excluded. Note that portable tanks are specifically exempt from tank requirements because they are considered containers and are not fixed to one location.

TSG — Refers to the Technical Support Group in ORAD.

Underground storage tank (UST) — A device meeting the definition of "tank" of which at least 10% of its volume (including any connected piping) is below the ground surface. For the purposes of this document, the definition of "underground tank" also includes "in-ground tanks," which are tanks situated such that a portion of the tank wall is within the ground, thereby preventing visual inspection of that portion of the tank that is in the ground. A vaulted tank is normally considered an underground tank as used at LLNL. If the vaulted tank meets the requirements of the *California Health and Safety Code*, Section 25283.5(e),[15] then it may be exempted from California UST regulations.

Upgraded tank system — Any existing tank system which is modified so that it will meet the design and construction criteria of a new tank system as mandated by federal, state, or local regulations.

UST — Underground storage tank.

Volatile Organic (VO) — An organic compound as determined by generator knowledge or direct measurement using EPA Method 25D; see 40 CFR 264.1083.

Volatile Organic Compound (VOC) — Any compound of carbon, excluding methane, carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates and ammonium carbonate; see Bay Area Air Quality Management District Regulation 1-3.

Waste Minimization — The reduction to the extent feasible of waste through source reduction or recycling activities. Waste minimization results in a reduction of the total quantity of waste or reduction of its toxicity, or both, as long as the reduction is consistent with minimizing present and future threats to human health and the environment.

Wastewater — Liquid waste consisting mostly of water from rinse operations that has the potential of containing hazardous or nonsewerable levels of contaminants. The contaminants could be hazardous, radioactive, or a combination of both.

WGMG — The Water Guidance and Monitoring Group in ORAD.

Appendix B

Environmental Regulations

For informational purposes, this section summarizes federal and state regulations governing the installation, operation, and closure of retention tank systems at LLNL. **Tables B-1, B-2,** and **B-3** summarize information about the regulatory drivers of nonhazardous, hazardous, mixed, and radioactive wastewater retention tanks. LLNL's environmental compliance program is designed to comply with these requirements. Applicable U.S. Department of Energy (DOE) Orders provide general policies and requirements regarding the management of the wastes retained in retention tank systems.

Federal Regulations

Retention tank systems collecting hazardous wastewater at LLNL are subject to the requirements of the U.S. Environmental Protection Agency's "Standards Applicable to Generators of Hazardous Waste," 40 CFR 262.[16] Specifically, Part 262.34 incorporates by reference the 40 CFR 265, Subpart J,[17] regulations governing the design, operation, and closure of tank systems for tanks used to store hazardous wastes for a period of less than or equal to 90 days. These are the implementing regulations for the Resource Conservation and Recovery Act (RCRA). The requirements of 40 CFR 265, Subpart J, apply to all tank systems, both aboveground and below ground, used for storing or treating hazardous waste. The regulations set forth requirements for:

- Design and installation of new tank systems and components, as well as assessment of the integrity of existing systems.
- General operating conditions.
- Secondary containment and release detection, in addition to a schedule for the retrofitting of existing systems. (Existing hazardous waste storage tanks installed prior to January 12, 1987, must be upgraded to meet new installation requirements by January 12, 1989, or when the system is 15 years old, whichever is later, according to 40 CFR 265.193.[9])
- Inspections.
- Response to leaks or spills.
- Closure and post-closure care.
- Management of ignitable, reactive, or incompatible wastes.

In August 1992, the state of California was granted the authority to enforce RCRA regulations, which includes 40 CFR 265.

40 CFR 112[18] requires the preparation and implementation of a Spill Prevention Control and Countermeasures (SPCC) Plan to prevent the discharge of "oil" into the environment. By definition, "oil" includes oil of any kind, petroleum products, and their wastes. Under 40 CFR 112, retention tanks that contain oily wastewater must be included in the facility's SPCC Plan. The Tank Assessments and Guidance Group (TAGG) coordinates LLNL's SPCC activities. The regulations attempt to ensure that tank systems are designed and operated to prevent any release of oily products and oily wastewater to the environment by requiring a method of spill containment (such as berms or sorbent materials), corrosion protection, testing, inspections, and operating procedures, etc.

The National Environmental Policy Act of 1969 (NEPA), the basic national charter for protection of the environment, requires all federal agencies to use a systematic decision-making approach to ensure that environmental implications associated with any proposal are considered along with economic and technical considerations. The regulations implementing NEPA created a process for evaluating federal actions consisting of three analysis levels, depending on whether the action could significantly affect the environment. The three levels are: (1) Categorical Exclusion, which applies to specific categories of actions that do not individually or cumulatively have a significant impact on the quality of the human environment; (2) Environmental Assessment, which is a document containing sufficient analysis and evidence of an action and its alternatives to support a conclusion that an action will not have a significant impact on the environment or that an Environmental Impact Statement must be prepared; and (3) Environmental Impact Statement, a detailed evaluation of an action and its alternatives conducted when a federal agency anticipates its action may significantly impact the environment.

DOE Orders

DOE Orders are internal directives that provide policy, guidelines, and requirements by which DOE operations will be managed. DOE Order 5480.4[22] specifies requirements for the application of mandatory environmental protection, safety, and health standards. The provisions of the Order are applicable to retention tank systems and are to be followed during facility design, construction, operation, modification, and decommissioning (i.e., closure). The Order also provides standards and guidelines that are not mandatory but are best management practices. DOE Order 5820.2A[23] specifies guidance on the management of radioactive waste. The Order includes guidelines for the design and operation of containers, including tanks, used to store radioactive and mixed waste. This Order applies mostly to high-level radioactive waste storage tanks, which are not currently present at LLNL, but also contains guidelines for storage and disposal of low-level waste.

DOE Order 5400.5[14] establishes DOE standards and requirements for protection of the public and the environment against undue risk from radiation. Potential exposures must be as far below the limits as is reasonably achievable (ALARA). DOE facilities must have the capabilities to monitor routine and non-routine releases. Chapter IV presents radiological protection requirements and guidelines for clean up of residual radioactive material.

State Regulations

The state of California regulates underground storage tanks (USTs) through the implementation of *California Code of Regulations* (CCR), Title 23, Division 3, Chapter 16.[19] These regulations set forth:

- Construction and monitoring standards for new UST systems.
- Monitoring and testing standards for existing UST systems.
- Unauthorized-release reporting requirements.
- Conditions that must be met to make repairs to a primary container.
- Closure requirements for USTs.

Enforcement of the state regulations, including inspections, approvals, etc., is the responsibility of the appropriate local agency (e.g., a county health department or local fire department). Different agencies within a county and/or state may have responsibilities for different actions.

In August 1992, the state of California received authorization to enforce Resource Conservation and Recovery Act (RCRA) regulations. State regulations are as or more stringent than the federal regulations. Hazardous waste storage tanks are regulated under 22 CCR. 22 CCR 66262.34[20] incorporates by reference, tank design and operation requirements of 22 CCR 66265.190 through 66265.199. Under 22 CCR, a hazardous waste facility permit is required if a tank stores hazardous waste for over 90 days, if hazardous waste is treated in the tank, or if the tank capacity is over 5,000 gallons or 45,000 pounds (whichever is greater). Enforcement of these regulations is by the California Department of Toxic Substances Control (DTSC) but can be deferred by agreement to a local agency, such as the county health department or other agencies responsible for underground storage tanks.

"Aboveground Storage of Petroleum," Chapter 6.67, Division 20,[21] of the *California Health and Safety Code* contains requirements for facilities with over 1,320 gallons total, or over 660 gallons storage in an individual tank, of aboveground storage of oil or oily wastes (> 5% oil). The regulations require that applicable facilities: (1) file a storage statement of tank locations, sizes, ages and contents; (2) pay a fee; (3) prepare (by January 1, 1991) a Spill Prevention Control and Counter Measures (SPCC) Plan in accordance with 40 CFR 112[18] (see discussion of SPCC Plan requirements in the "Federal Regulations" section); and (4) establish a monitoring program if the Regional Water Quality Control Board determines that a discharge from an aboveground tank facility will affect either surface waters/sensitive ecosystems or groundwater.

The California Environmental Quality Act (CEQA) of 1970 was enacted as a state equivalent of the federal NEPA. CEQA requires that California governmental and quasi-governmental agencies (such as Regional Water Quality Control Boards) evaluate proposed projects over which they have some level of approval, execution, planning, or permitting authority to determine whether significant impacts to the environment could occur. CEQA review is required of the State of quasi-governmental agency. To date, such agencies have not required input to their CEQA review processes from LLNL when applying for various tank permits.

Table B-1. Summary Table for Nonhazardous Wastewater Retention Tanks

Task	Driver
1. Proposed or Planning Stage	
❑ NEPA Documents	DOE regulations
❑ Waste Minimization	DOE requirement and federal regulations
2. Design *(See Appendix D for more details.)*	
❑ Material Compatibility	BMP
❑ Secondary Containment	BMP
❑ Overfill and Spill Controls	BMP
❑ Continuous Leak Monitoring	BMP
❑ Seismic Analysis	BMP
3. Construction *(See Appendix D for more details.)*	
❑ Installation Certification	BMP
❑ Corrosion Protection Certification	BMP
❑ Leak Testing	BMP
❑ Engineering Assessment	BMP
❑ Labeling	BMP
4. Operation and Maintenance *(See Appendix F for Inspection Frequencies and Appendix G for Sample Maintenance Log.)*	
❑ Operations Plan	DOE regulations
❑ Monitoring Plan	BMP
❑ Operator Training	BMP
❑ Daily Inspections or Other Monitoring	BMP
❑ Recordkeeping (including Maintenance Logs)	BMP
❑ Removal of Rainwater from Secondary Containment	State regulations
5. Closure (*See Appendix I for more details.)*	
❑ Closure Plan	BMP
❑ Closure Report	BMP
6. Reporting Requirements *(Document(s) sent to regulators.)*	
❑ Use Change	BMP
❑ Release / Leak into Environment	State requirements
❑ Proposed Installation	BMP
❑ Monitoring Plans	BMP
❑ Proposed Closure	BMP
❑ Completion of Closure	BMP

Notes: BMP = Best management practices
DOE = U.S. Department of Energy
NEPA = National Environmental Policy Act

Table B-2. Reference Summary Table for Hazardous and Mixed Wastewater Retention Tanks

Task	Driver
1. Proposed or Planning Stage	
❑ NEPA Documents	DOE requirements and federal regulations
❑ Waste Minimization	DOE requirements and federal regulations
2. Design *(See Appendix D for more details.)*	
❑ Material Compatibility	State and federal regulations
❑ Secondary Containment	State and federal regulations
❑ Overfill and Spill Controls	State and federal regulations
❑ Continuous Leak Monitoring	State and federal regulations
❑ Seismic Analysis	BMP
3. Construction *(See Appendix D for more details.)*	
❑ Installation Certification	State and federal regulations
❑ Corrosion Protection Certification	State and federal regulations
❑ Leak Testing	State and federal regulations
❑ Engineering Assessment	State and federal regulations
❑ Labeling	State and federal regulations
4. Operation and Maintenance *(See Appendix F for Inspection Frequencies and Appendix G for Sample Maintenance Log.)*	
❑ Operations Plan	DOE requirements
❑ Monitoring Plan	State and federal regulations
❑ Operator Training	State and federal regulations
❑ Daily Inspections or Other Monitoring	State and federal regulations
❑ Recordkeeping (including Maintenance Logs)	State and federal regulations
❑ Removal of Rainwater from Secondary Containment	State and federal regulations
5. Closure (*See Appendix I for more details.)*	
❑ Closure Plan	State and federal regulations
❑ Regulatory Inspections During Closure	State and county regulations
❑ Closure Report	State and county regulations
6. Reporting Requirements *(Document(s) sent to regulators.)*	
❑ Use Change	State and federal regulations
❑ Release/Leak into Environment	State and federal regulations
❑ Proposed Installation	State and federal regulations
❑ Monitoring Plans	State and federal regulations
❑ Proposed Closure	State and federal regulations
❑ Completion of Closure	State and federal regulations

Notes: BMP = Best management practices
DOE = U.S. Department of Energy
NEPA = National Environmental Policy Act

Table B-3. Reference Summary Table for Radioactive Wastewater Retention Tanks

Task	Driver
1. Proposed or Planning Stage	
❑ NEPA Documents	DOE regulations and federal law
❑ Waste Minimization	DOE requirement and federal regulations
2. Design ***(See Appendix D for more details.)***	
❑ Material Compatibility	DOE Order 5400.5, Chapter I, 5; and DOE Order 5820.2A, Chapter III, 3e (5) (f).[23]
❑ Secondary Containment	BMP to show compliance with DOE Orders 5400.5[14] and 5820.2A.[23]
❑ Overfill and Spill Controls	BMP to show compliance with DOE Orders 5400.5[14] and 5820.2A.[23]
❑ Continuous Leak Monitoring	BMP to show compliance with DOE Orders 5400.5[14] and 5820.2A.[23]
❑ Seismic Analysis	BMP to show compliance with DOE Orders 5400.5[14] and 5820.2A.[23]
3. Construction ***(See Appendix D for more details.)***	
❑ Installation Certification	BMP
❑ Corrosion Protection Certification	BMP
❑ Leak Testing	BMP
❑ Engineering Assessment	BMP
❑ Labeling	BMP
4. Operation and Maintenance ***(See Appendix F for Inspection Frequencies and Appendix G for Sample Maintenance Log.)***	
❑ Operations Plan	DOE Order 5820.2A, Chapter III, 3h (3) (d).[23]
❑ Monitoring Plan	DOE Order 5820.2A, Chapter III, 3h (3) (d).[23]
❑ Operator Training	BMP
❑ Daily Inspections or Other Monitoring	BMP
❑ Recordkeeping (including Maintenance Logs)	BMP to show compliance with DOE Orders 5400.5[14] and 5820.2A.[23]
❑ Removal of Rainwater from Secondary Containment	BMP to show compliance with DOE Orders 5400.5[14] and 5820.2A.[23]
5. Closure (*See Appendix I for more details.*)	
❑ Closure Plan	BMP to document compliance with DOE Order 5820.2A, Chapter V, 3c and 3d.[23]
❑ Closure Report	BMP to document compliance with DOE Order 5400.5, Chapter IV. [14]
6. Reporting ***(Documents sent to DOE.)***	
❑ Use Change	LLNL internal policy
❑ Release / Leak into Environment	DOE Order and Occurrence Reporting Requirement
❑ Proposed Installation	LLNL internal policy
❑ Monitoring Plans	LLNL internal policy
❑ Proposed Closure	LLNL internal policy
❑ Completion of Closure	LLNL internal policy

Notes: BMP = Best management practices
DOE = U.S. Department of Energy
NEPA = National Environmental Policy Act

Appendix C

Specific Environmental Protection Department Responsibilities

The following section describes specific Environmental Protection Department responsibilities relative to retention tanks. The **Environmental Restoration Division** in the **Environmental Protection Department (EPD)** determines the impact of hazardous material spills or leaks, or of past handling and disposal practices, and directs, plans, and conducts restoration activities to reduce environmental contamination to acceptable levels to protect human health and the environment.

The **Environmental Protection Department (EPD)** endorses the application of quality management and recognizes the role of a coordinated quality assurance management program.

The **Hazardous Waste Management (HWM) Division** manages and processes most LLNL-generated (Livermore Site, Site 300, and satellite facilities), non-sewerable wastes for the purpose of storage, treatment, possible discharge to sanitary sewer, and transportation for recycling or off-site disposal. HWM Division also provides sampling teams.

The **Operations and Regulatory Affairs Division (ORAD)** provides guidance to LLNL Programs and organizations to help ensure that retention tank systems are operated to meet environmental compliance requirements and to encourage recommended best management practices. ORAD also provides environmental compliance support by fulfilling requirements for permitting and reporting. ORAD conducts this work through six groups or projects: Environmental Evaluations Group (EEG), Tank Assessments and Guidance Group (TAGG), Environmental Operations Group (EOG), Permits and Regulatory Affairs Group (PRAG), Pollution Prevention Group (PPG), and Chemical Tracking Group. Three additional ORAD groups provide environmental and effluent monitoring and wastewater reporting and guidance: Water Guidance and Monitoring Group (WGMG), Terrestrial and Atmospheric Monitoring and Modeling (TAMM) Group, and Technical Support Group (TSG).

General Responsibilities for Oversight and Operation of Retention Tanks

The **Hazards Control Department** provides guidance and support so that Programs can meet their health and safety responsibilities. Hazards Control carries out this work through Environmental, Safety and Health (ES&H) Teams that are assisted by representatives from Health and Safety disciplines, EPD, and two technical disciplines. These representatives provide oversight to ensure that tank systems are constructed and operated properly.

TAGG within ORAD provides guidance on the design and operation of retention tank systems.

EOG in ORAD reviews existing operations for potential wastewater storage and disposal problems; assists organizations in finding effective controls or corrective actions; and assists Programs in ensuring that environmental controls and procedures are properly implemented. EOG also evaluates new facilities and operations for potential contaminants and compliance problems and works with organizations to develop pollution-abatement procedures in the early stages of project planning. EOG responds to environmental emergencies during normal working hours. (Environmental duty officers respond during off-hours.)

WGMG reviews analytical data and gives approval for discharge to the LLNL sanitary sewer.

The **HWM Division** arranges for proper treatment and disposal of hazardous, radioactive, and mixed waste and other nonsewerable wastewater.

The **EPD Training Section** within EPD educates and trains LLNL employees on environmental issues.

Responsibilities for Environmental Regulation Compliance and Guidance

ORAD provides guidance to LLNL organizations on environmental regulations through its groups as follows.

EEG prepares risk assessments, reports, and documentation for retention tank systems for compliance

with the National Environmental Policy Act and the California Environmental Quality Act.

TAGG obtains permits required for compliance with tank design, construction, operation, and maintenance regulations; meets with federal, state, and local regulators regarding permitting and compliance; guides regulators through inspections of LLNL facilities; and provides guidance and interpretation on how to comply with regulations. Also oversees the implementation of Spill Prevention Control and Countermeasures regulations.

EOG provides guidance on environmental regulations.

PRAG obtains permits required for RCRA-permitted facilities, including storage and treatment tanks.

Appendix D

Retention Tank Design and Construction Checklist

Tank ID:

Note: Items identified with an asterisk (*) are required by state or federal regulations for hazardous and mixed waste wastewater retention tank systems.

A. Administrative

1. _____ The proposed project has approved NEPA documentation.

2. _____ The tank system has been assigned an identification number by the Operations and Regulatory Affairs Division's (ORAD) Tank Assessments and Guidance Group (TAGG).

3. _____ ORAD, including TAGG, has reviewed and approved the design.

4. _____ The Environmental, Safety, and Health (ES&H) Team Leader reviewed and approved the design.

5.* _____ Provisions for obtaining any required permits have been made. Permits are required for:
Hazardous waste storage tanks >5000-gallon capacity.
Hazardous waste storage tanks if stored >90 days.
Underground storage tanks (UST) if regulated by the California UST regulations.

6.* _____ If the tank is a hazardous waste storage tank, an engineering assessment has been completed and stamped by an independent, California-registered, professional engineer before placing the tank in service.

7. _____ All documentation has been provided (e.g., drawings, specifications, installation inspection, leak test and corrosion certifications, etc.).

Notes: Existing tank systems are those that were installed prior to July 14, 1986, and are required to have an engineering assessment performed in accordance with 40 CFR 265.191[17] and 22 CCR 66265.191[26] if no secondary containment is provided.

New tank systems are those that were installed after July 14, 1986, and for which the requirements of 40 CFR 265.192[4] and 22 CCR 66265.192 [5] et seq. apply (e.g., secondary containment, engineering assessment, installation certifications, etc.).

For USTs, California law requires that tanks installed after January 1, 1984 (after December 22, 1988, for federal law), must have secondary containment, corrosion protection, overfill protection, etc.

B. Primary/secondary containment

1.* _____ The ability to leak test both primary and secondary containment for piping and tanks is provided. (Flanges or test valves for piping secondary containment are provided. **Note:** It is recommended that a 4-inch minimum opening access and an overhead clearance [approximately 3 feet] be provided for precision test equipment.)

2.* ____ Both primary and secondary levels of containment have been provided for all tanks and underground piping and ancillary equipment, unless exempt.

3.* ____ The volume of secondary containment is adequate. See 40 CFR 265.193(d)[9] and 22 CCR 66265.193(d).[10] ("Adequate" means that secondary containment can hold 100% of tank volume for single tank, 100% of largest tank if multiple tanks are contained within the same secondary containment structure, 150% of largest tank if a UST, or 10% of total volume if greater, plus the volume from a 25-year, 24-hour storm [approximately 4 inches] if exposed to rainfall.)

4.* ____ Tanks storing incompatible liquids are not located in the same secondary containment area.

5. _____ Tank systems are properly vented and evaluated for air permitting or abatement if the expected waste stream will contain volatile organic compounds or could emit ignitable or explosive vapors.

6.* ____ The secondary containment will prevent both vertical and lateral migration of wastes into the environment.

7.* ____ Secondary containment is designed such that it prevents infiltration of groundwater or run-off from entering the secondary containment. Vaults are tar-coated on exterior and sealed on the inside, if necessary to prevent groundwater or rainwater infiltration.

8. _____ Water stops have been placed at all joints in the secondary containment structure, if any. (Applies to concrete vaults or tanks.)

9.* ____ The secondary containment is sloped to a collection point, and a means to remove any accumulated liquid is provided, e.g., submersible pump, drain pipe, access for vacuum hose, etc.

10. _____ The primary and secondary containments are leak-tight and completely impervious to the contained substance for the intended life of the structure.

11. _____ All outlets (berm drains, sanitary sewer connections, and hose connections) have locking valves, locking caps, or the equivalent.

C. Leak detection

1.* _____ The system has some method of leak detection. **Note:** Automatic leak detection monitoring with alarm notification surveyed at least once every 24 hours is preferred; otherwise, use visual inspection every 24 hours that a tank system is in use.

2.* _____ For secondarily contained systems, a flow path is provided for leaks to be detected by automatic or visual detection (e.g., sloped to a sump, no obstructions to prevent flow, etc.).

D. Documentation

1.* ____ Drawings showing the actual location and orientation of the system, and the associated ancillary equipment are provided in the form of as-built drawings.

2. _____ A piping and instrumentation diagram (P&ID) is provided, showing the direction of flow; identifying all valves, pumps, indicators, and controls with a number; and showing all connections and flanges.

3. _____ A diagram is provided, showing the control panel layout and an elementary wiring schematic.

4. _____ An Operational Plan is provided for the system, including a system description, operator training requirements, operating procedures, system schematic, sampling instructions, inspection and monitoring instructions, emergency response procedures, and other information (as required).

5.* ____ A Monitoring Program that describes the monitoring requirements and procedures and leak response actions is provided. (This requirement applies only to California-regulated USTs, and it must be approved by Alameda County for Livermore Site or San Joaquin County for Site 300.)

6. _____ Two sets of the completed drawings and diagrams and one set of the construction specifications have been submitted to TAGG for that group's permanent files.

7. _____ A maintenance plan, including a list of components with their respective maintenance actions and schedule, has been provided to the tank system operator and TAGG.

8. _____ A complete list of the components being used has been compiled, indicating the manufacture's name, component name, and part number. (Verification of material compatibility is required; refer to checklist item G.1.)

9. _____ Vendor literature for tanks, level sensors, pumps, etc., including design standards, specification sheets, operating, maintenance and installation instructions, and other general information, has been retained for future reference. (Probably retained by Plant Engineering.)

10. _____ Copies of Material Safety Data Sheets for all materials of construction in contact with the waste are obtained from the respective manufacturers.

E. Construction certifications

1.* _____ Installation Inspection: Installation of the tanks has been inspected by a qualified, independent tank installation inspector or a similarly qualified, professional engineer; and a signed certification statement has been provided.

2.* _____ Corrosion Protection: Components that are subject to corrosion are designed (for California-regulated USTs), inspected, and any field installation or fabrication of corrosion-resistant materials is supervised by an independent, certified corrosion expert, and the signed certification of proper installation of the corrosion protection system is provided.

3.* _____ Leak Test: All components of the tank system (e.g., tanks, piping, secondary containment, etc.) have been tested for leak-tightness prior to placing the system in service, and a certification is provided stating that the system is leak-tight.

4.* _____ Proper UST Installation**:** Certification by the owner or owner's agent that the UST was installed properly by qualified personnel and that the system was inspected before being placed into use. (This requirement applies only to California-regulated USTs, and certification must be provided to the local regulatory agency on Form C from the State Water Resources Control Board.)

5. _____ All of the signed certification statements listed above have been retained in a permanent file, and copies of the certification statements have been submitted to TAGG for the group's permanent files.

F. Seismic analysis

1.* _____ Plant Engineering, or a contractor, has completed a seismic analysis in accordance with *Design and Evaluation Guidelines for Department of Energy Facilities Subjected to Natural Phenomena Hazards*.[6]

Ensure that appropriate factors have been used, e.g., category (General Use, Low Hazard, etc.), accelerations, seismic zone (Zone 4 for LLNL).

G. Material compatibility

1.* _____ The compatibility of all materials (tanks, coatings, liners, piping, pumps, valves, gaskets, O-rings, etc.) in contact with the substance(s) to be contained has been verified, or in-house tests have been performed to verify compatibility.

2. _____ Test documentation has been retained in permanent files.

H. Overfill and spill prevention

1.* _____ Spill prevention and removal capabilities are provided.

2.* _____ The system is provided with overfill protection (e.g., check valves, automatic shut-off, automatic by-pass, level indication, high-level alarms, etc.).

I. Corrosion protection

1.* _____ Potential corrosion (see 40 CFR 265.192 [a][3][4] and 22 CCR 66265.192[a][3][5]). (If metal in contact with soil or water, a corrosion analysis by a corrosion expert must be performed in accordance the regulations.)

2. _____ Corrosion-resistant materials have been used and/or corrosion-resistant materials installed.

3. _____ All metal surfaces are painted or coated.

4. _____ Any plastic (e.g., PVC, fiberglass, etc.) piping or components are painted or coated for ultraviolet protection.

5.* _____ Field installation of corrosion protection system was supervised by and certification provided by a corrosion expert.

J. General design considerations

The design at a minimum has considered the following items:

1.* _____ Settlement, compression, uplift. (Pad area is sufficient for load, “dead-man,” or other device used for underground tanks, etc.)

2.* _____ Wind loading. (Appropriate tank holddown straps, bolts, cables, etc., were used.)

3.* _____ Venting. (Check size of vents versus expected flow rates from pumps or drains, height of vents to avoid spillage from overfilling, float-check valves if necessary, explosion relief vents for petroleum tanks, etc.)

4.* _____ Sufficient anchoring and supports provided for piping, pumps, and tanks. (Tanks in vaults or berms must be properly anchored to resist seismic or buoyant forces.)

5.* _____ Soil conditions (e.g., settling and erosion potential).

6.* _____ Freeze protection has been provided in the form of insulation, heat tape, or other means for piping, tanks, and other equipment that may be susceptible to freezing.

7. _____ Adequate access provided for ease of maintenance, sampling, operation, and inspections.

8. _____ Vehicular traffic. (Access is provided for emergency vehicles; barricades are in place to protect equipment from vehicles, etc.)

9.* _____ All components of the tank system meet or exceed the applicable design and safety standards (U.S. Department of Energy, Uniform Building Code, American Society for Testing and Materials, Underwriters Laboratory, etc.). Design standards used must be clearly referenced on the drawings or in the construction specifications.

10.* _____ The backfill material is noncorrosive, porous, and homogeneous, and it has been carefully installed and uniformly compacted such that it supports the tank(s) and piping uniformly.

11.* _____ The proper depth of cover for all underground components has been provided to prevent damage from surface vehicular traffic.

12. _____ Dual storage tanks are provided to allow for sampling and analysis prior to disposal. Tank sizes are such that they ensure adequate capacity for expected flow rates and for four weeks of analysis turnaround time.

13. _____ System has mixing capability. **Note:** Mechanical mixing or air sparging are recommended. If pump recirculation is used, adequate mixing intensity must be provided (0.5 to 2.0 horsepower, or greater, depending on the tank geometry). An EPD Air Quality Specialist must evaluate sparging operations for possible permitting requirements.

14. _____ Flexible couplings or joints are provided where necessary. Long, straight runs of pipe terminating at a tank or other fixed object have been avoided.

15. _____ Tank system has had an operational test to verify that system controls and alarms operate as designed.

K. Labeling

1. _____ A permanent identification tag displaying the ID number of the tank assigned by TAGG is clearly visible and is affixed to the tank(s).

2.* _____ A permanent label describing the contents (e.g., hazardous waste, laboratory waste, toxic, radioactive, flammable, etc.) of the tank system is affixed to the tank(s).

3.* _____ If the tank(s) stores hazardous waste, a label is attached to each tank with a date entered for when the storage of the hazardous waste began.

Appendix E

Inspection Logs for Wastewater Retention Tank Systems

Daily Inspection Log for Hazardous or Mixed Waste Retention Tank Systems

Tank No(s)._____ **Building No.** _____

Instructions: Check (√) if item has been inspected and does not need corrective action. If corrective action is needed, initial within the respective box. Indicate N/A for item that is not applicable. Identify volume in tank. Provide Inspector/Employee information. Identify corrective actions if necessary.

Inspection Items	S	M	T	W	Th	F	S
Overfill/Discharge Control Equipment 1. Waste Cutoff System Operating							
2. Automatic Bypass System Operating							
3. Drainage System Operating							
4. Recirculating Pump(s) Operating							
5. Transfer Pump(s) Operating							
6. Overfill/Discharge Equip. Problem Free							
7. Other							
Monitoring Equipment 8. Enter the Pressure Gauge Reading							
9. Enter the Temperature Gauge Reading							
10. Alarm System Operating							
11. Leak Detection Equipment Operating							
12. Monitoring Equipment Problem Free							
13. Other							
Tank/Frame/Piping/Valve Condition/ Welds & Joints 14. No Leaks							
15. No Visible Cracks or Buckling							
16. No Visible Corrosion							
17. No Stains or Blistering							
18. No Visible Problems							
19. Other							

Inspection Items	S	M	T	W	Th	F	S
Berm/Secondary Containment 20. Contaminated Vegetation Absent							
21. Berms Free of Liquid and Stains							
22. Free of Debris							
23. No Stains							
24. No Visible Cracks							
25. Drainage Valve Closed							
26. Any Containers Free of Leaks and Stains							
27. Other							
Surrounding Area 28. Free of Erosion							
29. No Unexplained Change in Vegetation							
30. Other							
Operating Instructions Posted							
Tank Labeled Hazardous or Mixed Waste							
"NO SMOKING" Sign Posted							
Liquid Waste Level [Measurement]							
31. Open Top Tank Volume [Conversion Gals.]							
32. Closed Top Tank Volume							

Inspection Date	_____[S]	_____[M]	_____[T]	_____[W]	_____[Th]	_____[F]	_____[S]
Time	_____	_____	_____	_____	_____	_____	_____
Inspector Name (printed)							
Inspector Signature							

Item No.	Date	Tank/Area	Comments/Corrective Actions Needed	Nature of Repairs	Actions Corrected by	Date Action(s) Corrected

Note: Open-top tanks must have a minimum 2-foot clearance from the top of the tank to the level of the liquid.

Weekly Inspection Log for Nonhazardous Waste Retention Tank Systems for the month of _____, 19____

Tank No(s)._____ **Building No.** _____

Instructions: Check (√) if item has been inspected and does not need corrective action. If corrective action is needed, initial within the respective box. Indicate N/A for item that is not applicable. Identify volume in tank. Provide Inspector/Employee information. Identify corrective actions if necessary.

Inspection Items	Inspection Date				
Overfill/Discharge Control Equipment					
1. Waste Cutoff System Operating					
2. Automatic Bypass System Operating					
3. Drainage System Operating					
4. Recirculating Pump(s) Operating					
5. Transfer Pump(s) Operating					
6. Overfill/Discharge Equip. Problem Free					
7. Other					
Monitoring Equipment					
8. Enter the Pressure Gauge Reading					
9. Enter the Temperature Gauge Reading					
10. Alarm System Operating					
11. Leak Detection Equipment Operating					
12. Monitoring Equipment Problem Free					
13. Other					
Tank/Frame/Piping/Valve Condition/ Welds & Joints					
14. No Leaks					
15. No Visible Cracks or Buckling					
16. No Visible Corrosion					
17. No Stains or Blistering					
18. Problem Free					
19. Other					

Inspection Items	Inspection Date				
Berm/Secondary Containment					
20. Contaminated Vegetation Absent					
21. Berms Free of Liquid and Stains					
22. Free of Debris					
23. No Stains					
24. No Cracks					
25. Drainage Valve Closed					
26. Containers Free of Leaks and Stains					
27. Other					
Surrounding Area					
28. Free of Erosion					
29. No Unexplained Change in Vegetation					
30. Other					
Operating Instructions Posted					
Liquid Waste Level [Measurement]					
31. Open Top Tank Volume [Conversion Gals.]					
32. Closed Top Tank Volume					

Inspection Date	_____	_____	_____	_____	_____
Time	_____	_____	_____	_____	_____
Inspector Name (printed)					
Inspector Signature					

Item No.	Date	Tank/Area	Comments/Corrective Actions Needed	Nature of Repairs	Actions Corrected by	Date Action(s) Corrected

Note: Open-top tanks must have a minimum 2-foot clearance from the top of the tank to the level of the liquid.

Appendix F

Minimum Inspection Tasks and Frequencies for Hazardous, Radioactive, and Mixed Wastewater Retention Tank Systems

The table below provides the tasks and frequencies of inspections required for hazardous, radioactive, and mixed[24] wastewater retention tank systems and recommended for nonhazardous wastewater retention tank systems.

Frequency	Task
Daily (Weekly for nonhazardous)	Visually check valve stems and flanges for leakage.
	Visually check piping for misalignment, ultraviolet deterioration, bending, or leakage with particular attention to tees, couplings, gaskets, elbows, and connections.
	Visually inspect containment berm for integrity.
	Visually inspect all exterior tank surfaces, welds, rivets/bolts, and foundation for signs of corrosion, erosion, staining, leaking, blistering, or buckling.
	Inspect ground surface around vertical and horizontal tanks for signs of leakage.
	Check discharge and fill-control equipment before wastewater is added to ensure adequate capacity.
	Check discharge valve from bermed area to ensure that it is closed and locked.
	Check walkways and stairways for obstructions.
	Check and record level of tank contents.
	Check liquid level gaging equipment to ensure that it is functioning properly.
	Check vents and pressure relief devices for obstructions.
	Check to see if bermed area needs to be drained.
Bimonthly*	Check impressed current cathodic protection systems.
Quarterly*	Check grounding lines and connections for integrity.
	Check stairways for damaged rungs or handrails.
	Check fire extinguishing equipment.
	Inventory all spill control and other emergency response equipment.

Continued on next page

* These inspection requirements are recommended for nonhazardous wastewater retention tank systems. The appropriate tank representative assigned to your respective ES&H Team should be consulted for applicability of inspection items.

Frequency	Task
Annually (recommended)	Perform nondestructive thickness testing of piping and valves.
	Perform nondestructive thickness testing of tank walls.
	Visually inspect tank liners.
	Test structural stability of support structures for elevated tanks and test pressure relief valves for calibration.
	Measure tank-to-soil potential for underground tanks or piping.
	Perform a system operation check.
	Perform a precision test (for USTs without continuous or visual leak detection).

Note: Check sacrificial anode cathodic protection systems within six months of installation and at least every three years thereafter.

Appendix G

Sample Maintenance Log

Component	Maintenance Action	Minimum Maintenance Cycle	Date Maintenance Completed					
Tank	Paint	Every 2 years						
Pump #1	Bearings lubricated	Monthly						
	Seals replaced	Yearly						
	Bearings replaced	Yearly						
Pump #2	Bearings lubricated	Monthly						
	Seals replaced	Yearly						
	Bearings replaced	Yearly						
Valves	Seals replaced	Yearly						
Aboveground pipes	Painted	Every 2 years						
Impressed current corrosion protection	Recalibrate	Yearly						
Secondary containment berm	Resistance coating	Every 2 years						

Tank No. _____ **Building No.** _____

Appendix H

Procedure for Handling Rainwater in Secondary Containment and Release Form

Following a rainstorm, operators need to determine whether the liquid found in a secondary containment structure open to precipitation can be considered rainwater only and disposed of accordingly. When liquid thought to be rainwater is discovered in a secondary containment structure, a thorough inspection of the system must be performed to assess whether the liquid is rainwater or is the result of a spill from the tank system. This inspection must include the steps given below. This appendix also provides release forms for rainwater in secondary containment of nonhazardous or radioactive tank systems and of hazardous or mixed waste tanks systems.

1. Check leak monitoring equipment, overfill protection devices, and spill prevention devices for signs of system malfunctions.

2. Check level of tank(s) for unexplained level changes or exceptionally high level.

3. Check tank(s), piping, pump(s), valves, and joints for signs of leakage (e.g., drips, stains, wet spots, cracks, bulges, etc.).

4. Check color and clarity of the liquid for any signs of contamination and for presence of an oil sheen.

5. Check records to ensure that all historic spills have been adequately cleaned, residues removed, and post-cleanup samples taken.

6. Test the pH level of the liquid. (pH level is acceptable for discharge to storm drain or ground if it is within the range of 6.5 to 8.5). If the pH is outside of this range, contact the wastewater representative in the Operations and Regulatory Affairs Division.

The accumulated water from the first rainstorm of the season is considered potentially contaminated with hazardous constituents and must be collected, sampled, and analyzed for the constituents normally found in the tank system wastewater. Following the above inspection and if the rainwater from the first rainstorm is found to be noncontaminated, future rain water will be managed according to the following steps:

7. Perform a radioactive contaminant screening analysis for tanks associated with Radioactive Material Management Area (RMMA) buildings. If the results are above the 25-dmp screening level, then contact Hazardous Waste Management Division for proper protocol for the disposal of bermed water.

8. If there is no sign of a release from the tank system, nor any indication of the presence of hazardous constituents, off-color, turbidity, odor, or oil sheen, and if pH is within the range of 6.5 to 8.5, then the rainwater can be released to the storm drain system or the ground.

   If there is indication of a tank system release, or hazardous or radioactive constituents are present within the secondary containment, spill response procedures must be immediately initiated, and assessment of any releases to the environment must occur.

   If the results of the inspection are inconclusive, the liquid must be sampled and analyzed for the constituents normally found in the tank system wastewater and disposed of properly according to the analyses results.

9. If collected rainwater is drained through a berm drain, ensure that the berm drain cap is replaced and locked, and/or the drain valve is shut and locked after the rainwater is discharged.

10. A record of rainwater discharges must be maintained by the Program. The record must include the date of discharge, the amount of rainwater (in inches) discharged, any observations, the name of the Environmental Analyst assigned to the Program, and the name and signature of the person performing the rainwater inspection and discharge. Records must be maintained for a minimum of three years and be made available for review.

If the analytical results indicate the presence of contaminants in the rain water, and the pH is outside the allowed range for discharge to ground, the accumulated rain water must be either discharged to the sanitary sewer system (with authorization from the Environmental Protection Department) or sent to the Hazardous Waste Management Division for disposal. All other liquids must be collected in appropriate containers.

Hazardous or Mixed Retention Tank System
Secondary Containment Rainwater Release Form

Date/Time of Inspection:	**Operator's Name *(Print)***	**Tank Number(s):**
Rainwater Location:	**Operator's Name *(Signature)***	**Tank Contents:**

Instructions: **Check the appropriate response for each item below and record the information indicated. Provide descriptions and comments if necessary. Attach additional pages if extra space is needed. Check "N/A" for items that do not apply. This record is to be maintained by the Program for a minimum of three years and made available by request of EPD or regulatory personnel. If a spill is detected, send a completed copy to TAGG (L-633) of ORAD/ EPD. Note: Appendix H of the *Guidelines to Retention Tank Systems* provides detailed procedures for handling rainwater in secondary containment.**

Check Items	Response	Description and Comments
1. Is this the first rain storm of the season?	Yes ❑ No ❑	_____
2. If not the season's first rain storm, did sample results of the season's first rain storm show contamination? If Yes, indicate contaminants.	Yes ❑ No ❑	_____ _____ _____
3. Take the pH of any liquid within the secondary containment. Is pH outside the range of 6.5 to 8.5? Note: If a field pH meter is used, record the calibration pH using buffer solutions at pH 4, 7, and 10.	Yes ❑ No ❑	pH calibrations: _____ pH reading: _____ pH meter #: _____
4. Is there a spill visible, as defined by a film or sheen upon or discoloration of the surface of the water, or sludge or emulsion deposited beneath the surface of the rainwater in the secondary containment structure?	Yes ❑ No ❑	_____ _____ _____
5. Do the leak-monitoring equipment, overfill protection devices, or spill-prevention devices show signs of system malfunction?	Yes ❑ No ❑	_____ _____
6. Does tank(s) have unexplained level changes or exceptionally high levels?	Yes ❑ No ❑	_____
7. Do the tank(s), piping, pump(s), valve(s), and joints show signs of leakage (e.g., drips, stains, wet spots, cracks, bulges)?	Yes ❑ No ❑	_____ _____
8. For tanks associated with Radioactive Material Management Areas (RMMA), perform a radioactive contamination screening. Record level. Are the results above the 25-dpm screening level?	Yes ❑ No ❑ N/A ❑	Radioactivity screening level: _____ _____ _____
9. Have you informed your supervisor of the results?	Yes ❑ No ❑	_____
10. Has approval from Program Responsible Person (someone other than the tank operator) been received? Note: Program approval is required before discharge.	Yes ❑ No ❑ N/A ❑	_____ _____
11. If all Items 1 through 8 are "No," release rainwater from the secondary containment to storm drainage system and re-secure valve (if the system has one). a. Has the rainwater been released? b. Has the EOG Analyst been notified of the release?	a. Yes ❑ No ❑ N/A ❑ b. Yes ❑ No ❑ N/A ❑	_____ _____ _____ _____
12. If any Items 1 through 8 are "Yes," do not release rainwater. Contact the EOG Analyst assigned to the Program for guidance on proper disposition of water. Has the EOG Analyst been contacted?	Yes ❑ No ❑ N/A ❑	_____ _____ _____
13. If rainwater in the secondary containment is contaminated, inform the responsible tank owner so that the cause can be verified and repairs made as necessary. Notification completed?	Yes ❑ No ❑ N/A ❑	_____ _____ _____
14. If radioactivity is above the screening level, has HWM Division been contacted to pump out liquid?	Yes ❑ No ❑ N/A ❑	_____
15. Final disposition of rainwater: Released to storm drainage system ❑ (Record date and time of discharge to storm drainage system) Pumped out ❑		Date of Discharge: _____ Time of Discharge: _____

Name of Program Responsible Person *(Print)*	**Signature of Program Responsible Person**	**Date:**

Nonhazardous or Radioactive Retention Tank System
Secondary Containment Rainwater Release Form

Date/Time of Inspection:	**Operator's Name *(Print)***	**Tank Number(s):**
Rainwater Location:	**Operator's Name *(Signature)***	**Tank Contents:**

Instructions: **Check the appropriate response for each item below and record the information indicated. Provide descriptions and comments if necessary. Attach additional pages if extra space is needed. Check "N/A" for items that do not apply. This record is to be maintained by the Program for a minimum of three years and made available by request of EPD or regulatory personnel. If a spill is detected, send a completed copy to TAGG (L-633) of ORAD/ EPD. Note: Appendix H of the *Guidelines to Retention Tank Systems* provides detailed procedures for handling rainwater in secondary containment.**

Check Items	Response	Description and Comments
1. Take the pH of any liquid within the secondary containment. Is pH outside the range of 6.5 to 8.5? Note: If a field pH meter is used, record the calibration pH using buffer solutions at pH 4, 7, and 10.	Yes ❑ No ❑	pH calibrations: _____ pH reading: _____ pH meter #: _____
2. Is there a spill visible, as defined by a film or sheen upon or discoloration of the surface of the water, or sludge or emulsion deposited beneath the surface of the rainwater in the secondary containment structure?	Yes ❑ No ❑	_____
3. Do the leak-monitoring equipment, overfill protection devices, or spill-prevention devices show signs of system malfunction?	Yes ❑ No ❑	_____
4. Does the tank(s) have unexplained level changes or exceptionally high levels?	Yes ❑ No ❑	_____
5. Do the tank(s), piping, pump(s), valve(s), and joints show signs of leakage (e.g., drips, stains, wet spots, cracks, bulges)?	Yes ❑ No ❑	_____
6. For tanks associated with Radioactive Material Management Areas (RMMA), perform a radioactive contamination screening. Record level. Are the results above the 25-dpm screening level?	Yes ❑ No ❑ N/A ❑	Radioactivity screening level: _____
7. Have you informed your supervisor of the results?	Yes ❑ No ❑	_____
8. Has approval from Program Responsible Person (someone other than the tank operator) been received? Note: Program approval is required before discharge.	Yes ❑ No ❑ N/A ❑	_____
9. If all Items 1 through 6 are "No," release rainwater from the secondary containment to the storm drainage system and re-secure valve (if the system has one). a. Has the rainwater been released? b. Has the EOG Analyst been notified of the release?	a. Yes ❑ No ❑ N/A ❑ b. Yes ❑ No ❑ N/A ❑	_____
10. If any Items 1 through 6 are "Yes," do not release rainwater. Contact the EOG Analyst assigned to the Program for guidance on proper disposition of water. Has the EOG Analyst been contacted?	Yes ❑ No ❑ N/A ❑	_____
11. If rainwater in the secondary containment is contaminated, inform the responsible tank owner so that the cause can be verified and repairs made as necessary. Notification completed?	Yes ❑ No ❑ N/A ❑	_____
12. If radioactivity is above the screening level, has HWM Division been contacted to pump out liquid?	Yes ❑ No ❑ N/A ❑	_____
13. Final disposition of rainwater: Released to storm drainage system ❑ (Record date and time of discharge to storm drainage system) Pumped out ❑		Date of Discharge: _____ Time of Discharge: _____

Name of Program Responsible Person *(Print)*	**Signature of Program Responsible Person**	**Date:**

Appendix I

Tank Closure Checklist

Tank Number: _____

Note: This checklist is intended as a guide only. Contact the Tank Assessments and Guidance Group (TAGG) for specific and current requirements and procedures.

Tank Closure Preparation

❑ For hazardous and mixed waste retention tanks, begin tank closure procedures 180 days before last use.

❑ Note the "approval" date on the Closure Plan; regulatory approval is valid for only 90 days from that date. If the approval has expired, review the Closure Plan for any items that need to be updated. Contact the regulatory agency and inform them of any changes to the Closure Plan due to the delay and request an extension on their approval.

Approval date: _____

❑ Contact TAGG so that the appropriate regulatory agency can be contacted at least two working days (48 hours) prior to tank removal. If the tank is in an Exclusion Area, notify the regulatory agency five days in advance so that, if a regulatory agency inspection is necessary, security arrangements for the inspector can be made. For the Livermore site, the Bay Area Air Quality Management District must also be notified five days in advance if the tank has contained gasoline or other volatile organic material.

❑ Inform the Hazardous Waste Management (HWM) Division Shipping Supervisor that the tank removal will take place. Ensure that any participation from the HWM Division is clearly understood by both HWM and Operations and Regulatory Affairs Division (ORAD).

❑ Inform the Environmental, Safety, and Health (ES&H) Team Leader of the tank removal project. Specify the expected schedule for activities and the type of waste/product material involved. The responsible Environmental Analyst or the Program representative is the lead for arranging for disposal of waste.

❑ View the video tapes, "Tank Closure Without Tears" and "What Do We Have Here? An Inspector's Guide to Site Assessment at Tank Closure," which can be found in the ORAD library. These videos need to be reviewed prior to tank closure.

❑ Fill out a Sample Requisition form and give to the technician who will do the sampling two to three weeks before the tank closure begins. Inform the technician when work begins and when sampling is expected. Find out from the Program and let the technician know if the sample analyses will be on a rush order.

❑ The location of all underground utility, gas, and water lines must be marked with chalk or an environmentally safe spray paint. Do not rely on the site plot for the location of all underground utilities. Use an underground line locating service, which is normally contracted through Plant Engineering. Line locating should be scheduled at the time the Closure Plan is submitted to the regulatory agency for approval.

Tank Closure Activity

❑ Identify who is responsible for the excavation and removal work (i.e., Plant Engineering Labor Shop foreman if work is done by LLNL; Plant Engineering Project Manager or Construction Manager if work done by outside contractor).

❑ Just before work to remove the tank system is scheduled to begin, conduct a pre-closure meeting to go over the requirements of the Closure Plan and the responsibilities of the people involved (e.g., identify who is the designated safety person), highlight the requirement to place soil piles on plastic, and cover piles and excavations with plastic if there is possibility of rain, make sure workers have Superfund Amendments and Reauthorization Act of 1986/ Occupational Safety and Health Act (SARA/OSHA) training, etc.

❑ A copy of the "approved" Closure Plan must be at the job site. The Closure Plan is the official document by which closure activities are dictated. Any significant deviations from the "approved" Closure Plan must be approved by the Tank Closure Coordinator and possibly by the TAGG Group Leader or ERD Group Leader.

❑ Verify that the required personnel (including field personnel) have read and understand the Closure Plan. Obtain all necessary signatures on the Closure Plan Sign-Off Sheet.

❑ If possible, remove all liquid and sludge from the tank and piping prior to disconnecting any pipes or excavating. Make sure that any residual liquid in exposed pipes is prevented from escaping or is contained and not permitted to leak into the surrounding soil.

❑ All required safety equipment must be available and used, such as safety shoes, hard hat, etc.

❑ Samples must be from locations specified in the "approved" Closure Plan. The samples must be prepared and analyzed using the methods specified in the "approved" Closure Plan. If the physical conditions of the site preclude obtaining samples from the prescribed locations, the samples will be taken from as near as possible to the prescribed locations. The new sample locations and the physical conditions causing the relocation will be fully described in a bound field notebook.

❑ Make sure that the excavation and excavated soil pile are covered with plastic and that the soil pile is placed on plastic. If more than one hole is being excavated for multiple tanks, make sure that the soil for each excavation is kept separate.

❑ Record the Hazardous Waste Manifest numbers and/or the Hazardous Waste Disposal Requisition numbers used to dispose of the tank, piping, liquid or solid residue from the tank, contaminated soil, etc.

Tank Manifest # _____

Liquid Manifest # _____

Soil Manifest # _____

❑ Inform the HWM Division Shipping Supervisor when the tank removal is completed and the need to dispose of it within 30 days; request the TSD-to-Generator copies of the waste manifest for (1) the tank and associated piping, (2) the rinsate and sludge, and (3) any contaminated soil.

❑ While awaiting disposal or reuse, the removed tank must be vented (1/8-inch vent hole) to relieve pressures generated by temperature fluctuations. Ensure that the vent plug is always on the tank top.

❑ Tanks should be labeled with legible letters, at least 2 inches high, indicating former tank contents, vapor state, vapor-freeing treatment, and date.

❑ For tanks at Site 300, affix the San Joaquin County tank ID# onto the tank end using fluorescent spray paint. **Note:** The San Joaquin County Tracking Sheet must accompany each tank removed from the site. The Tracking Sheet can be found in the Closure Plan. (The Tracking Sheet is in addition to a waste manifest.)

❑ If an unexpected/unknown leak or spill is detected, immediately notify TAGG so that decisions can be made regarding (1) the reporting of the leak to the regulatory agency, (2) any additional sampling that may be necessary, and (3) the disposal of contaminated material.

Tank Closure Follow-Up

❑ Obtain lab analysis results from the sampling technician and make sure that all results are signed by the lab personnel.

❑ Make sure that all data requested for the samples have been provided and that proper/requested analysis techniques were used (e.g., correct EPA analysis numbers, holding times not exceeded, etc.). Also make sure that Chain-of-Custody forms are included with the analysis results and that proper transfer procedures were followed.

❑ Make sure that the responsible Environmental Operations Group (EOG) Environmental Analyst also reviews the analysis results and comes to the same conclusions regarding presence of soil contamination.

❑ Keep the Program informed of the progress of the closure at all times. All communications should go through the responsible Environmental Analyst when notifying the Program of progress or problems.

❑ Obtain copies of the TSD-to-Generator copy of the Hazardous Waste Manifest for the tank, piping, liquid, soil, etc., from the HWM Division to be included in the Closure Report.

❑ Prepare and submit a Closure Report necessary to the regulatory agency.